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ARCHIVES OF OTOLARYNGOLOGY

VOLUME 32 JULY 1940 NUMBER 1

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ARTIFICIAL FISTULA IN CASES OF OTOSCLEROSIS

LOUIS K. GUGGENHEIM, M.D.

AND

PAUL GUGGENHEIM, M.D.

LOS ANGELES

The history of the fistula operation for otosclerosis has been so frequently detailed that repetition here would be superfluous. From coast to coast a marked and, we believe, unwarranted enthusiasm has been manifested for a new technic [1] in creating an opening in the horizontal canal. The failures, attributed by various reporters to imperfect skill, seem to stem but little the prevailing optimism. One piece of experimental work, by Canfield,[2] is refreshing and will be followed, it is hoped, by further research and a more careful analysis of the fundamental factors involved in the treatment of progressive deafness.

The first fact unrecognized by the proponents of the fistula operation is that otosclerosis is not only an osseous dystrophy producing an obstruction to sound conduction but is also a disease of the eighth nerve producing perception deafness; so even though a fistula operation should prove to be successful, it could in no way inhibit further deterioration of the neural mechanism.

The treatment of otosclerosis by means of (1) reversal of halisteresis [3] and (2) regeneration of the damaged neural mechanism through dietary regulation and the administration of calcium, phosphorus and vitamins has after three years of experimentation succeeded in producing improvement in hearing far greater than has any fistula operation

From the Department of Otolaryngology of the University of Southern California.

Read at the meeting of the Western Section of the American Laryngological, Rhinological and Otological Society, Los Angeles, Jan. 27, 1940.

1. Lempert, J.: Improvement of Hearing in Cases of Otosclerosis: A New One Stage Surgical Technic, Arch. Otolaryng. **28**:42 (July) 1938.

2. Canfield, N.: Labyrinthine Fistulas: Report of Experiments on Vital Response to Various Methods of Producing Defects in Bone, Arch. Otolaryng. **30**:50 (July) 1939.

3. Guggenheim, L. K.: On the Diagnosis and Treatment of Otosclerosis, Am. J. Surg. **42**:156 (Oct.) 1938.

thus far reported. This treatment requiring analysis of diet and a knowledge of the biochemistry of vitamins lacks the dramatic appeal of the surgical procedure but will, we believe, be the ultimate solution of the problem.

The next fact to be considered is that even when the artificial fistula remains patent to the extent of allowing a positive reaction of vertigo on pressure, the same fistula may be incapable of transmitting sound waves. The case here reported, in which the operation was performed by neither of us, illustrates that point:

REPORT OF A CASE

D. M., a woman aged 21 years, unmarried, had been hard of hearing for twelve years. She presented no history of otitis media. Inquiry into the family history revealed that her father and brother and a paternal cousin were deaf.

Tinnitus was present. The vestibular function was normal. The Rinne test gave a negative reaction on both sides. The reaction to the Schwabach test was prolonged. The drum membranes were negative, with normal mobility.

Air	1/9/39 Before Operation	10/11/39 8½ Mo. After Operation Fistula Reaction Positive	12/11/39 10½ Mo. After Operation Fistula Reaction Negative
128	50	54	68
256	62	66	74
512	63	63	70
1,024	66	63	73
2,048	45	50	44
4,096	42	74	73
8,192	58	58	70

A fistula operation was done on the left ear on Jan. 25, 1939. On Oct. 11, 1939 the fistula still reacted positively to tests for vertigo, but on Dec. 11, 1939 the reaction was negative. On Jan. 5, 1939, before operation, tests of hearing made on the left ear revealed that the whispered voice sibilants were audible at a distance of 4 inches (10 cm.) and nonsibilants at a distance of 1 inch (2.5 cm.). On Dec. 11, 1939, after operation, when the reaction of the fistula to tests for vertigo was negative, tests of hearing made on the left ear revealed that the whispered voice was not audible at all, while the loud conversational voice was heard at a distance of 2 inches (5 cm.).

The audiometric readings for the patient's left ear were as follows:

It may be noted that nearly nine months after operation, despite a positive fistula reaction, the hearing had deteriorated. After closure of the fistula further loss of hearing occurred.

While there is as yet no histologic explanation of why a patent fistula reacting positively to vertigo tests may be a nontransmitter of sound waves, we take the liberty of hypothesizing. The fistula is near the ampullae of the horizontal and the anterior vertical canal. When pressure is exerted with a cotton-covered applicator, a minute but sufficient tug is made on adhesions which have sprung up between the membrane filling the fistula and the membranous canal to produce a reaction from the neuroepithelium of the cristae, but because of the

nature of these adhesions, sound waves are not transmitted to the labyrinthine fluids.

The third fact that should be recognized is that the ingenious, difficult and time-consuming technic which has produced coast to coast enthusiasm has nothing whatever to do with the success or failure of the fistula operation.

We have witnessed the new operation as performed by an otologist of consummate skill, have examined the patients before and after the operation and are convinced that every step in the operation has been in perfect accord with the conception of the originator of the technic. Certain points in the procedure and the final picture stand out prominently. In the first place, the claim that the pars flaccida, or Shrapnell's membrane, is used to cover the fistula, is not accurate; furthermore, no part of the drum membrane covers the fistula, as can be seen plainly after final healing. The entire drum membrane is far removed from the fistula region in the healed ear. This being the case, one is forced to the conclusion that the difficulties and complexities of the procedure, including mobilization of the drum membrane and removal of the head of the malleus, have no point whatever. There is little doubt that the old and simple approach to the horizontal canal posteriorly and covering of the fistula with any membrane at hand will work as well and take one sixth of the time.

The essential purpose of the fistula operation is to achieve permanence of the osseous fistula as a transmitter of sound waves. If the fistula falls a prey to osseous regeneration, it is unfortunate. If the fistula remains a potential source of vertigo but does not transmit sound waves, that too is unfortunate.

Stimulated by the experiment of Canfield, we undertook the present research with two purposes in mind: first, to substantiate or disprove Canfield's conclusion that a sharp instrument produces osseous regeneration while the burnishing burr inhibits any reformation of bone; secondly, to experiment with an additional factor of inhibition.

The research was carried out in the department of Dr. John Mackenzie Brown, at the University of Southern California. The work on animals was done through the courtesy of Dr. Clarence M. Hyland, of the Children's Hospital of Los Angeles. Adult white rabbits were used.

The two divisions of the work were concerned, respectively, with (1) the status of the fistula eighteen days after operation and (2) the conditions two months and two days after operation. In addition to the two methods used by Canfield, a third was added, namely, the use of the burnishing burr followed by electrocoagulation of the edge of the fistula. We present first the eighteen day experiment:

FISTULA EIGHTEEN DAYS AFTER OPERATION

A. Fistula Made with a Sharp Chisel.—Figure 1 illustrates the condition of an eighteen day old fistula made with a sharp chisel. In the upper left corner of the figure may be seen a portion of the original bone, and below and on the left are spicules of dead bone. In the lower right part of the illustration is the mesenchymal sponge filling the greater portion of the fistula. This sponge shows, centrally, undifferentiated pluripotential mesenchyme, around which are newly formed connective tissue and myriads of osteoblasts. Between the original bone and the sponge is a mass of newly formed membrane bone showing tremendous osteoblastic activity. At the edge of the original bone is a trabecula of newly formed bone with a definite line of demarcation. The osteoblasts in epithelioid alinement at the edge of this trabecula continue along the edge of the original bone. The marrow spaces in the newly formed bone are large and of fibrous type.

B. Fistula Made with a Burnishing Burr.—Figures 2 to 7 show the status eighteen days postoperatively of a fistula made with a burnishing burr. The entire fistula (fig. 2) is seen to be filled with mesenchymal sponge comprising central undifferentiated mesenchyme, surrounded by young connective tissue and myriads of osteoblasts. Nowhere is there any evidence of osteogenic activity. The edges of original bone show open haversian canals and marrow spaces and a number of necrotic bone chips. Some of the splintered bone masses are separated by a newly formed fatty marrow.

Under a higher magnification (fig. 3) the connective tissue-mesenchyme content of the sponge can better be studied. There is no evidence of new bone formation.

At a different level, however, in the same fistula, quite another picture presents (fig. 4). On the right side of the photomicrograph, no osteogenesis appears and the sponge has contracted away from the edge of the original bone. But on the upper, the left and the lower edge is noted a large amount of new bone with large marrow spaces. Where the new bone joins the original is a sharp line of demarcation (cementum). Enormous osteoblastic activity may be observed throughout. The marrow is not fatty but purely osteoplastic. A neighboring section (fig. 5) shows a contraction of sponge everywhere except on the right, where trabeculae of new bone are actively being formed. It is to be noted that the haversian canals and marrow spaces are open. The marrow spaces are filled with osteogenic marrow, not fat.

Figure 6 is a higher magnification, showing a sealed edge of original bone from which the most lively new bone formation is springing. Note the cementum lines and osteoblasts in epithelioid alinement. Between the new bone area and the undifferentiated mesenchyme is a line of young connective tissue.

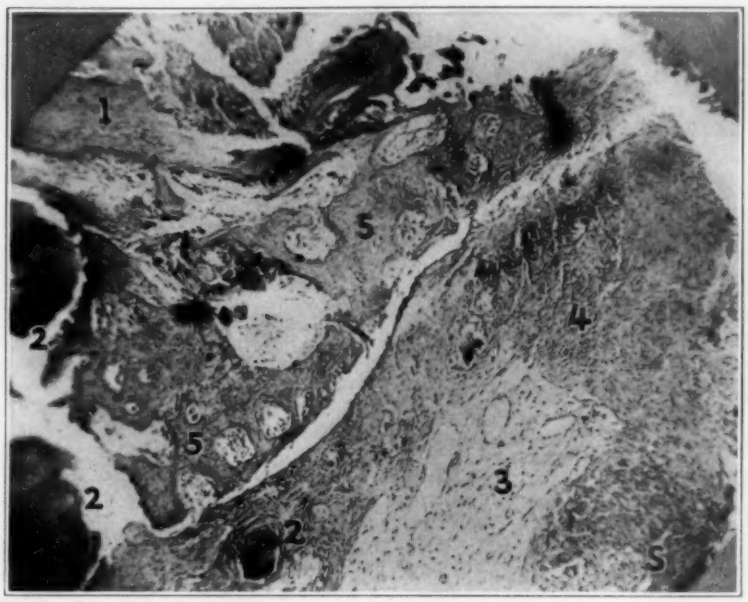

Fig. 1.—Fistula made with a sharp chisel, as it appeared eighteen days after formation: *1*, trabecula of original bone; *2*, spicules of dead bone; *3*, undifferentiated mesenchyme; *4*, newly formed connective tissue, and *5*, new bone.

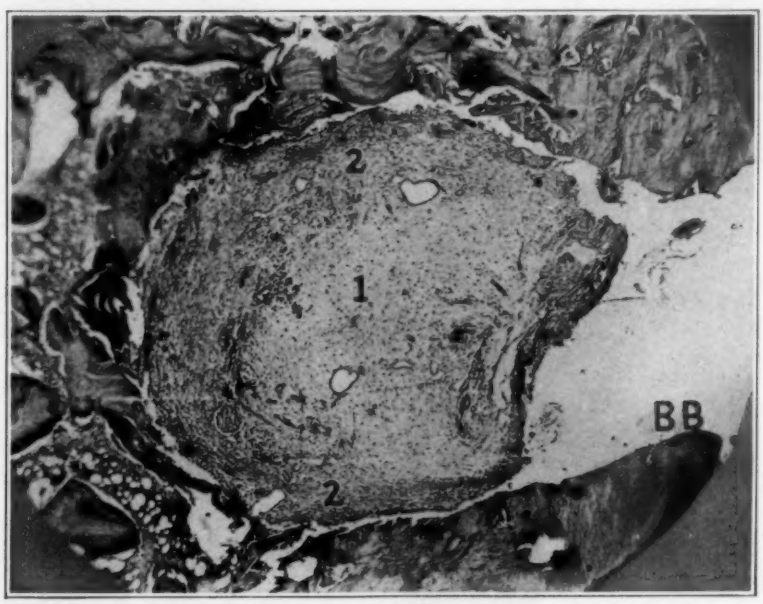

Fig. 2.—Fistula made with a burnishing burr, eighteen days after formation: *1*, undifferentiated mesenchyme, and *2*, newly formed connective tissue.

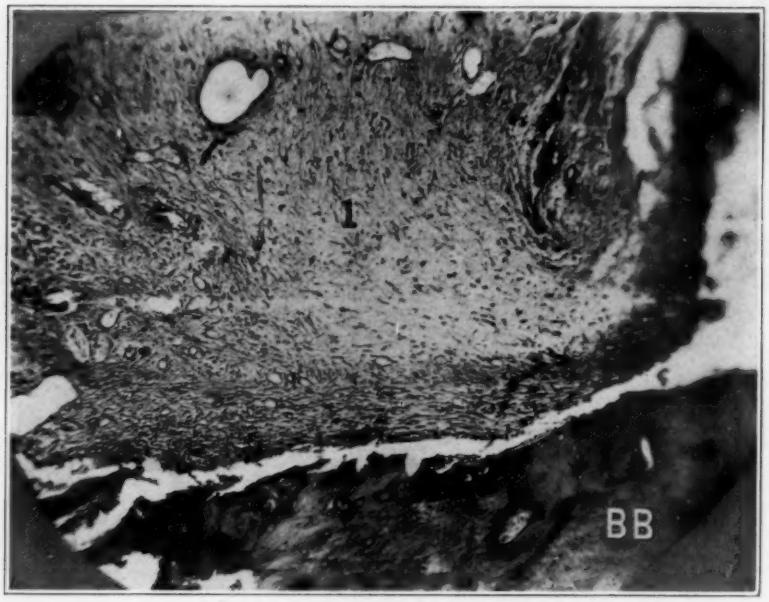

Fig. 3.—Fistula made with a burnishing burr, eighteen days after formation: *1*, mesenchyme.

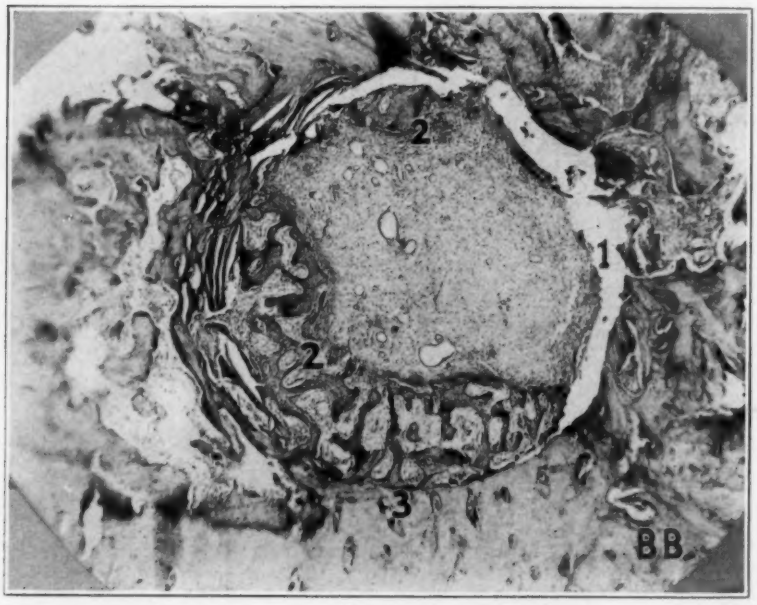

Fig. 4.—Fistula made with a burnishing burr, eighteen days after formation: *1*, contraction of sponge from the edge of the original bone; *2*, new bone, and *3*, cementum line between original bone below and new bone above.

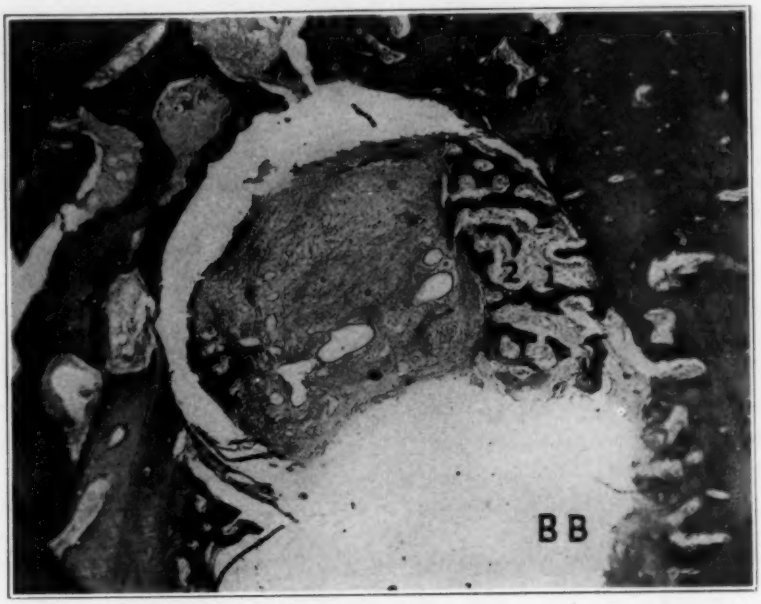

Fig. 5.—Fistula made with a burnishing burr, eighteen days after formation: *1*, trabecula of new bone and *2*, osteogenic marrow.

Fig. 6.—Fistula made with a burnishing burr, eighteen days after formation: *1*, sealed edge of the original bone; *2*, cementum lines; *3*, osteoblasts in epithelioid alinement, and *4*, connective tissue.

Contrasted with figure 6 is figure 7, which shows the edge of the original bone not sealed by the burnishing burr but with haversian canals and marrow spaces wide open.

C. Fistula Made with a Burnishing Burr and Electrocoagulation.—Figures 8 to 10 illustrate the condition of the fistula made by the combined method. Under low power (fig. 8) the fistula is seen to be filled with a mass of young connective tissue and much less undifferentiated mesenchyme than developed after the use of the burnishing burr alone. At the lower right edge are three streaks of carbonized bone, where the electrocoagulating needle penetrated the original bone. Nowhere is there any evidence of osteogenic activity.

Under higher magnification (fig. 9) it is seen that the mesenchyme–connective tissue sponge contains myriads of osteoblasts but that complete inhibition of osteogenesis prevails. The areas of electrocoagulation are plainly in evidence.

Figure 10 shows the smooth, carbonized edge of original bone and a central area of penetration. In the sponge are two spicules of dead bone chip but no new bone formation. However, along the edge of original bone on the right are osteoblasts in epithelioid alinement, presaging the formation of new bone in the not distant future.

FISTULA TWO MONTHS AND TWO DAYS AFTER OPERATION

A. Fistula Made with a Sharp Chisel.—The status of the fistula two months and two days after its formation with a sharp chisel is well shown in figures 11 and 12. Figure 11 presents the sharp fistula with an astonishingly small amount of new bone formation, most of the area being filled with a fatty marrow and with islands of hemopoietic cells. A striking feature appears, namely, the complete absence of bone activity: There is not a single osteoblast to be seen; all osteogenesis has ceased; the picture is final.

Figure 12, made at another level, tells the same story: fatty marrow, extremely little new bone and no osteogenic activity.

B. Fistula Made with a Burnishing Burr.—In figures 13 and 14 the status of a fistula two months and two days after its formation with a burnishing burr is illustrated. Figure 13 shows a large amount of new bone formation. Surrounding the central mass of bone is fibrous marrow, and next to the original bone on the right is fatty-hemopoietic marrow. Nowhere is there any osteoblastic activity. The process of osteogenesis has been completed.

In figure 14, at a different level, is a mass of dense fibrous marrow on the left and fatty-hemopoietic marrow on the right. The trabeculae of new bone are wide and dense. Between the original bone on the right and the new bone are lines of demarcation. There is no bone activity; the process is ended.

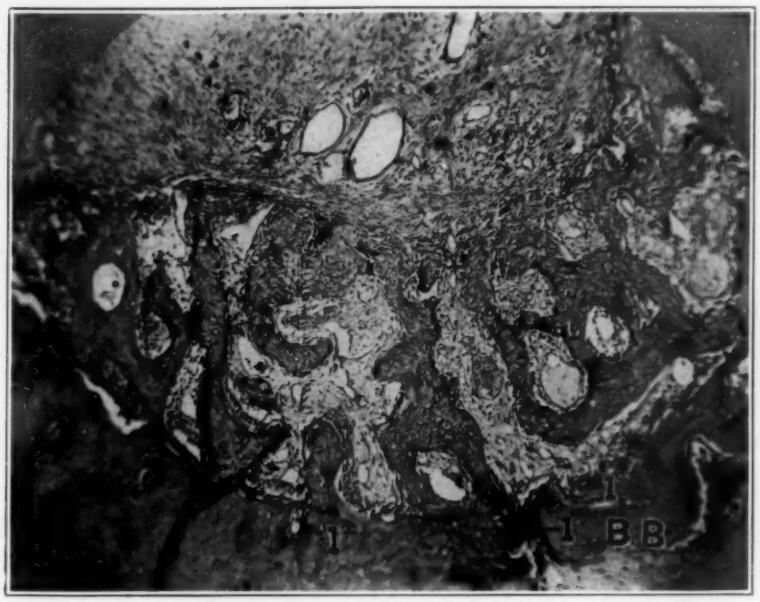

Fig. 7.—Fistula made with a burnishing burr, eighteen days after formation: *1* indicates haversian canals and marrow spaces open.

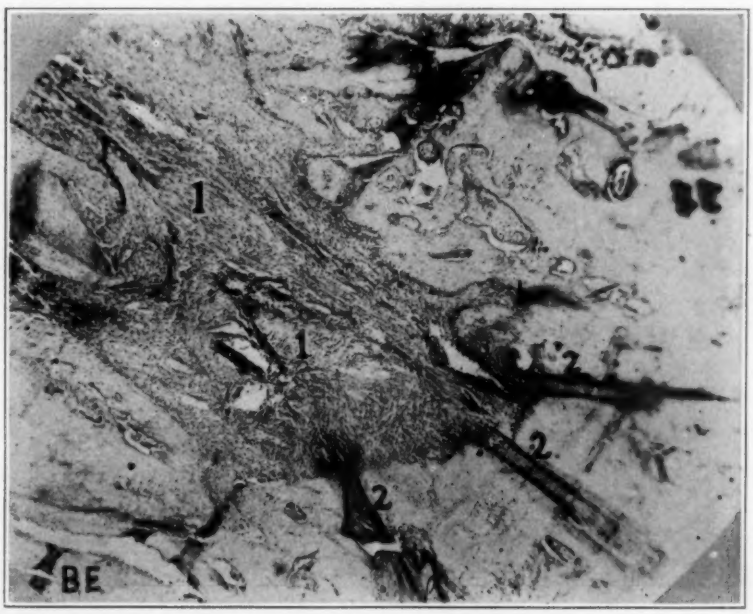

Fig. 8.—Fistula made with a burnishing burr and electrocoagulation, eighteen days after formation: *1*, connective tissue sponge, and *2*, lines of electrocoagulation.

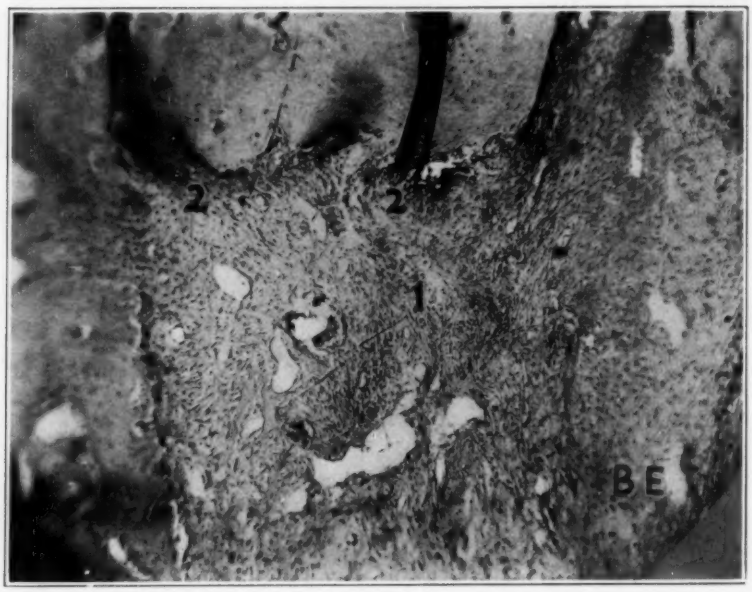

Fig. 9.—Fistula made with a burnishing burr and electrocoagulation, eighteen days after formation: *1*, connective tissue sponge, and *2*, areas of electrocoagulation.

Fig. 10.—Fistula made with a burnishing burr and electrocoagulation, eighteen days after formation: *1*, carbonized edge of original bone; *2*, central penetration of needle; *3*, spicules of dead bone, and *4*, osteoblasts in epithelioid alinement.

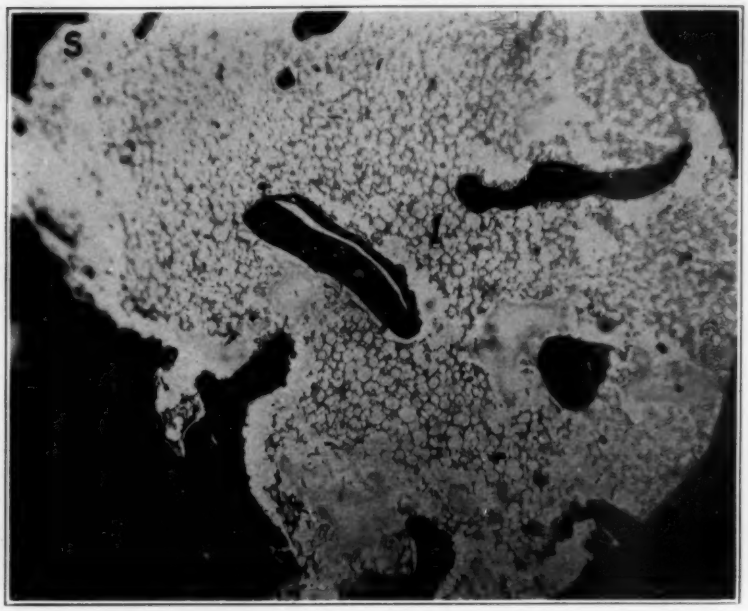

Fig. 11.—Fistula made with a sharp chisel, two months and two days after formation: *1* indicates fatty hemopoietic marrow.

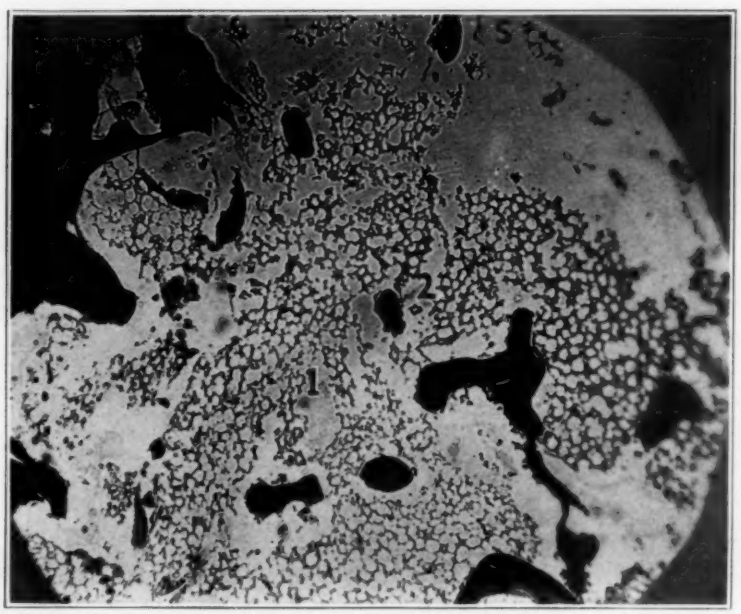

Fig. 12.—Fistula made with a sharp chisel, two months and two days after formation: *1*, fatty marrow, and *2*, new bone.

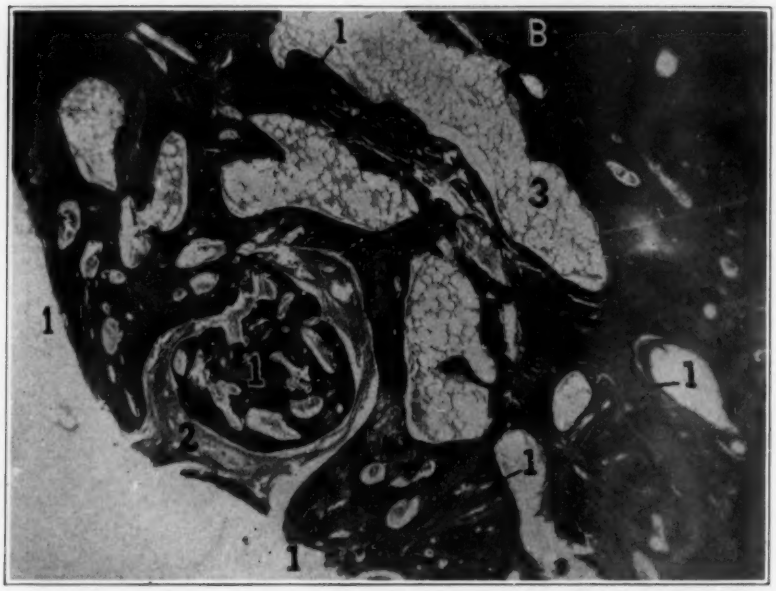

Fig. 13.—Fistula made with a burnishing burr, two months and two days after formation: *1*, newly formed bone; *2*, fibrous marrow, and *3*, fatty marrow.

Fig. 14.—Fistula made with a burnishing burr, two months and two days after formation: *1*, fibrous marrow; *2*, fatty marrow; *3*, trabeculae of new bone, and *4*, cementum line.

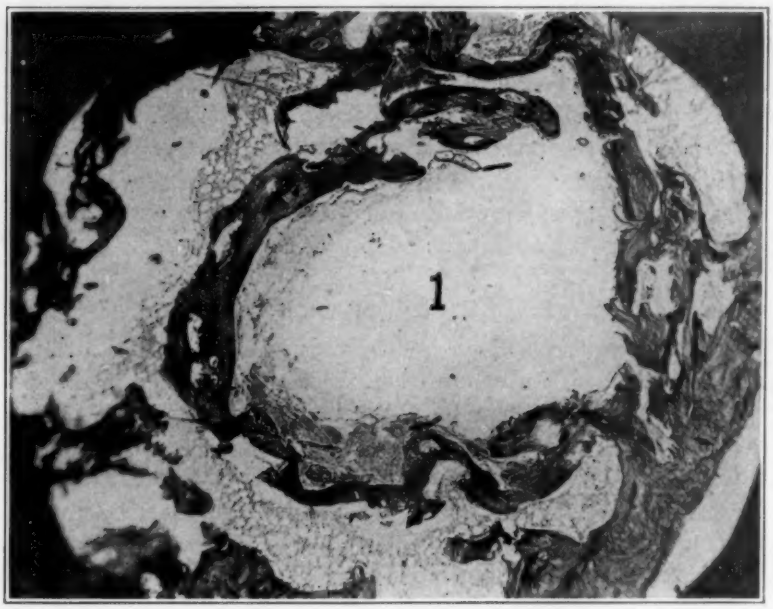

Fig. 15.—Fistula made with a burnishing burr and electrocoagulation, two months and two days after formation: *1* indicates central area free of bone.

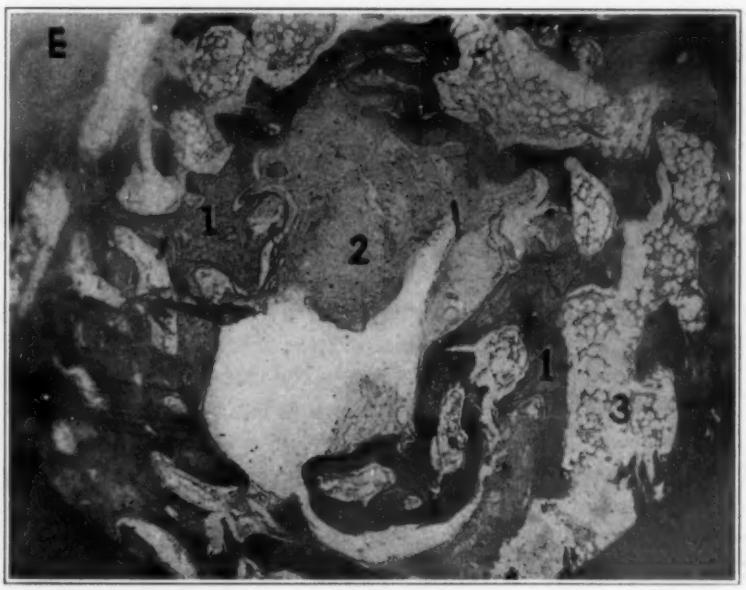

Fig. 16.—Fistula made with a burnishing burr and electrocoagulation, two months and two days after formation: *1*, new bone; *2*, mass of fibrous marrow, and *3*, fatty marrow.

C. Fistula Made with a Burnishing Burr and Electrocoagulation.—Figures 15 and 16 show the status after two months and two days of a fistula made by the combined method. In figure 15 the fistula is seen to have remained free of new bone in its center. The fatty marrow content has been lost in preparation. There is no bone activity.

Figure 16, at a different level, shows slightly more new bone formation, no osteoblastic activity, a central mass of fibrous tissue and fatty-hemopoietic marrow elsewhere.

SUMMARY OF DATA

In an osseous fistula there occurs after eighteen days a lively and widespread new bone formation when the fistula has been made with a sharp instrument or with a burnishing burr. No evidence of osteogenesis is seen at this time when the use of the burnishing burr has been followed by osteodesiccation by means of electrocoagulation.

At the end of two months and two days all osteoblastic activity has ceased and all mesenchyme has been replaced either by fatty marrow with islands of blood-forming cells or by fibrous marrow. It is noted that the most patent fistula results from the use of a sharp instrument. Next in patency comes that made with the burnishing burr used in connection with electrocoagulation. In that made with the burnishing burr alone the largest amount of new bone formation occurs.

CONCLUSIONS

We have failed to substantiate Canfield's conclusion that the use of the burnishing burr is not followed by new bone formation. The most favorable result as to fistula patency was achieved with a sharp chisel.

The fistulas here reported were, as in Canfield's experiments, not in the labyrinthine capsule but in the membrane bone of the skull. The fact that the labyrinthine capsule consists of both membrane and cartilage bone in no way affects the experiment, as all new bone formation, whether in the labyrinthine capsule or elsewhere, is by membrane-bone process. The ontogenetic phenomenon of the transformation of cartilage model into bone model is *strictly* an ontogenetic occurrence and never a repair process.

One must realize that in this type of research it is necessary to study serial sections taken through the whole depth of any given fistula. As our results show, it is possible to find sections which reveal no evidence of osteogenesis in a fistula which is actually regenerating bone. Consequently one photomicrograph cannot be taken as representative of the status of an entire fistula unless other sections taken throughout its depth have been studied.

In the final analysis of osteogenesis in artificial fistulas, the individual characteristics of primary germinal tissue (mesenchyme) will doubtless prove to be the determining factor just as they are in such conditions as chondrodystrophy and osteogenesis imperfecta and in connection with individual potentialities for fracture healing.

We believe the subject is of enormous scientific interest and hope that the enthusiasts for the new operation will seek expression in the laboratories until the procedure is on a basis which will justify the operation on human beings. It is hoped that if and when that time comes the neuropathy of otosclerosis will receive the consideration it deserves along with the other factors.

No mention has been made of the approach through the canal as opposed to the posterior approach, as the time-honored posterior one is obviously superior for all purposes.

5000 Finley Avenue.

GANGRENE AND INFECTION OF THE EAR, NOSE AND THROAT COMPLICATING DIABETES MELLITUS

A REVIEW OF CLINICAL MANIFESTATIONS WITH SURGICAL CONSIDERATIONS AND REPORT OF A CASE

SOL A. GOLDBERG, M.D.
PHILADELPHIA

In view of the prevalence of infection in the ear, nose and throat, it is to be expected that this should be encountered from time to time in patients suffering with diabetes mellitus. In a recent review of the literature, it was surprising to note that whereas the importance of infection in these patients has been stressed repeatedly when occurring elsewhere, scant reference is made to infection in the ear, nose and throat, with the exception of mastoiditis complicating diabetes mellitus. Gangrene in that region is even more of a rarity. Such, perhaps, was the conclusion of Dibold and Huber [1] when they questioned the infrequency of infection in this area and as a result of their study of 194 cases observed that diabetic patients die more frequently of infection than of diabetes mellitus or any other cause.

The present study has been actuated primarily by the desire to contribute to the clinical study of gangrene apart from the addition of an interesting and unusual case. When all is said and done, however, the study becomes in reality an analysis of predisposing factors in the production of gangrene, infection, trauma, aberrant metabolism, vascular deficiences and, finally, anatomic peculiarities. It is based on the personal observation of a patient afflicted with diabetes and suffering from an acute exacerbation of chronic sinusitis, complicated by gangrene of the inferior turbinate, the ethmoid capsule and the nasal septum.

The role of infection in the production of gangrene is hardly illustrated more poignantly in lesions in any other location than in those involving the intranasal structures. Knowledge of the importance of infection in this respect is contingent in no small measure on the recognition of the manifestations of infection, altered variously by aberrant

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Thesis submitted to the Faculty of the Graduate School of Medicine of the University of Pennsylvania in partial fulfilment of the requirements for the degree of Master of Medical Science (M.Sc. [Med.]) for graduate work in otolaryngology.

1. Dibold, H., and Huber, K.: Wundheilung bei Diabetes, Fortschr. d. Therap. **14**:113 (March) 1938.

carbohydrate metabolism. Bearing this in mind, I have found it necessary to deviate somewhat from the primary purpose of this study, to include a brief review of the more common appearances of infection, supplemented by several pertinent observations on the effect of wound healing and on special indications for operation.

REVIEW OF THE LITERATURE

Gangrene arising in the course of diabetes mellitus has been recorded for over a century. It was not, however, until less than two decades ago that involvement of the intranasal structures was first reported by Morris,[2] Connell [3] and Bowers.[4] In 1924, when Austin G. Morris reported a case of gangrene of the middle turbinate, sequestration of the nasal septum and mucocele of the frontal sinuses, he found in the literature no mention of gangrene of the turbinates. The condition in the case which he reported was complicated further by the involvement of the third, the fourth, the ophthalmic branch of the fifth and the sixth nerve. However, earlier the same year, Bowers reported a series of 3 cases. All the patients were children under 10 years of age. The first, 4 years 8 months of age, had involvement of both the inferior and the middle turbinate. Two of the patients died, the deaths occurring in the preinsulin period. The third was treated with insulin, to which the recovery was attributed.

Several months later, Connell reported a case somewhat similar to that presently to be recorded by me; beginning with acute bilateral purulent ethmoiditis, the condition extended to the right antrum, and an induration of the skin of the nose and of the upper lid of the right eye developed. As the ethmoid infection improved, the cartilaginous septum became ulcerated, increasing in size until the entire cartilaginous septum, the perpendicular plate of the ethmoid bone and the vomer had sloughed away. He pointed out the unusual occurrence in youth and also asserted that diabetic gangrene of the intranasal structures had not been noted previously. Ardeshir,[5] 1926, reported a case of that disease in a child of 8 years, resulting in a loss of the left alar cartilage.

Three years later, in 1929, Bulger,[6] reported the case of a young woman with gangrenous involvement of the left naris and the inner

2. Morris, A. G.: Gangrene of the Middle Turbinate, Sequestration of the Nasal Septum, Mucocele of Frontal Sinuses, in a Case of Diabetes, New York State J. Med. **24**:987 (Dec.) 1924.

3. Connell, E. S.: Diabetic Gangrene of the Nose, J. Missouri M. A. **21**:277 (Aug.) 1924.

4. Bowers, C. H.: Gangrene in the Nose Complicating Diabetes, J. A. M. A. **82**:1325 (April 26) 1924.

5. Ardeshir, K.: Gangrene of the Nose Due to Diabetes Mellitus, Lancet **1**: 1256 (June 26) 1926.

6. Bulger, H. A.: Gangrene of the Orbit and Nares in Diabetes Mellitus, J. Missouri M. A. **26**:304 (June) 1929.

aspect of the left orbit, a condition resulting in death from coma. He made an analysis of the cases which had appeared in the literature to that date, finding a mortality of 50 per cent and noting that half of these deaths had occurred in the preinsulin era. Since that time isolated reports, such as those of Wood [7] and Brier,[8] have been published, but no effort has been made to parallel the work of Bulger or to bring it up to date. In the case reported by Brier, the skin anterior to the external ear was the site of the primary lesion, which spread to the external auditory canal and subsequently involved the fifth and the seventh nerve. Gangrenous involvement of the cheeks and lips have been reported by Brooks [9] and Sturgis [10] and recently by Millett,[11] March 1939, with the record of 2 cases in which the condition resulted in death. In the following summary, I have included only those cases in which there was unquestionable involvement of the nose, ear and throat by the gangrenous process.

ANALYSIS OF CASES REPORTED

Gangrene as a complication of diabetes mellitus in the ear, nose and throat is not common. With the case presented in this paper, a total of 10 cases have been reported. Available statistics fail to shed any light on the relation of the incidence of gangrene in this region to that of gangrene occurring elsewhere. Any attempt to arrive at such a relation must, of necessity, be mere conjecture, and the ratio may safely be accepted as less than 1 per cent. Sex is no factor, and the incidence is greatest in the first decade of life. In all but 2 of the 10 cases the condition was confined to children and young adults. Involvement of the external auditory canal was seen in 1 case, of the alar cartilage in 1 case, of the septum per se in 2 cases and of the septum with secondary involvement of the remaining intranasal structures in 6 cases. Arteriosclerotic vascular disease may be accepted unquestionably in 2 cases. Syphilitic infection was seen in 1 case, that in the case reported by Wood, of an elderly woman suffering from syphilis as well as diabetes. Concomitant infection was noted in all cases. The process may vary from a partial destruction of the nasal structures to a complete

7. Wood, T. B.: Spontaneous Amputation of the Nose Due to Diabetic Gangrene, Ann. Otol., Rhin. & Laryng. **46**:1112 (Dec.) 1937.

8. Brier, A. J.: Diabetic Gangrene of the Face and Ear Complicated by Fifth and Seventh Nerve Involvement, J. A. M. A. **103**:1704 (Dec. 1) 1934.

9. Brooks, G. P.: Diabetic Gangrene of the Face, Brit. M. J. **2**:539 (Sept. 21) 1929.

10. Sturgis: A Case of Slough of the Lip in a Diabetic Patient, Boston M. & S. J. **124**:261, 1891.

11. Millett, J.: Diabetic Gangrene of the Face, J. A. M. A. **112**:1143 (March 25) 1939.

spontaneous destruction of the nose, associated with extensive disfigurement. The common bacterial inhabitants of the nose, such as Streptococcus, Staphylococcus, Pneumococcus and Micrococcus catarrhalis, as well as saprophytes, have been recovered.

UNDERLYING PATHOLOGIC CONDITION

Gangrene in this area is of the moist variety, the type most frequently seen in the deeper structures in the presence of putrefactive organisms. The interesting features in this group of cases are (1) that gangrene is prevalent (incidence 80 per cent) at an age when primary vascular sclerosis is uncommon, (2) that infection exists in all cases and (3) that trauma coexists in the form of chronic irritation.

The question arises: What is the underlying mechanism productive of gangrene? Before attempting to answer this question, I wish to note the various factors predisposing to the development of infection in patients suffering from diabetes mellitus and thus indirectly favoring the production of gangrene. These factors, which will be discussed in the succeeding section, are (1) nutritional disturbances, (2) increased amounts of dextrose, (3) vascular deficiencies and (4) the presence of toxins.

As the result of infection there follows a progressive inflammatory change in the walls of the smaller arteries and veins of the nose. This change is most striking in the smaller endarteries and is characterized by a proliferation of the endothelial layer of the intima, a process associated with cellular infiltration in the subendothelial connective tissue. The same changes result from chronic irritation produced by chemical irritants. Hyperglycemia and hypercholesteremia are concomitant findings in diabetes mellitus. It is my opinion that sugar and cholesterol acquire irritant properties when present in excessive amount. To what extent the cholesterol deposits depend on the increased amount of cholesterol in the blood of these patients is not known. Hewlett [12] pointed out that Anitschkou emphasized the possible relation when arterial changes developed in rabbits to which he fed cholesterol. This constant irritation of the intima is undoubtedly an important factor, leading to early proliferative and later degenerative changes in the endothelium and the closely connected subendothelial connective tissue. There follows a progressive narrowing of the vascular bed together with disturbed nutrition in the area involved. The point is ultimately reached at which the sudden release of the products of altered metabolism, such as occurs during the period of coma, suffices to produce complete closure of the vessels with gangrene.

12. Hewlett, A. W.: Pathological Physiology of Internal Diseases, ed. 3, New York, D. Appleton and Company, 1928, p. 242.

Another question arises: What is the relation of coma to gangrene? This has been answered in part by the foregoing paragraph. During coma the blood stream is literally overwhelmed by the increased dextrose and by a shower of acetone and diacetic acid. It is my feeling that these substances acting locally on the already damaged vascular bed or indirectly on the sympathetic nervous system, much as a pressor substance, are responsible for the development of thrombosis and gangrene.

It may thus be said that, with several exceptions, gangrene in this area may be properly conceived of as a pathologic entity, dependent primarily on diabetes, infection and trauma.

Buerger,[13] in describing the diagnosis and pathologic process of the so-called diabetic gangrenes, called attention to four distinct varieties of the disease, namely (1) the arteriosclerotic, (2) the thrombotic, (3) the embolic and (4) the thromboangiitis obliterans form. The essential features of the four types may be described briefly as follows:

1. The arteriosclerotic type occurs in persons of advanced years and involves the larger arteries, especially those of the periphery, in vessels the site of advanced arteriosclerosis. This type is characterized by proliferation of the endothelial lining, with an increase of the subendothelial connective tissue, as well as by fatty degeneration, with the deposition of fat, lipoids and cholesterol. The necrosis is associated with atrophy and calcification of the tunica muscularis and the tunica adventitia, leading to occlusion.

2. Thrombotic gangrene occurs in vessels which are the site of arteriosclerosis of a mild degree and is characterized by sudden occlusion as a result of thrombus formation. This type likewise is most common in the peripheral vessels.

3. Embolic gangrene is a sequel to the lodging of an embolic mass. This mass is carried frequently from some distant focus and when infected leads to suppuration, abscess formation and gangrene. This type of gangrene may occur in vessels that are otherwise normal.

4. Thromboangiitis obliterans is characterized by involvement of the superficial veins and arteries by an acute inflammatory process resulting in thrombus formation and subsequent occlusion.

The present study supports the observation and conclusion that gangrene in the nose is almost uniformly of the type described as thromboangiitis obliterans. It certainly cannot be attributed to arteriosclerosis, occurring as it does in a period when the vessels are for the most part devoid of primary degeneration and atheromatous change.

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13. Buerger, L.: The Pathology and Diagnosis of So-Called Diabetic Gangrene, Arch. Diagnosis **8**:101-118 (April) 1915.

FACTORS FAVORING INFECTION

Turning briefly to infection per se, I should like to stress again its frequent occurrence and the fact that it constitutes the foremost barrier to the well-being of the patient suffering from diabetes. It acts frequently as an explosive force. Considerable discussion has arisen relative to the factor favoring infection in these cases. This has been attributed by Zimmermann [14] and others to nutritional disturbances, by Naunyn [15] to the presence of sugar in the blood and body tissues, by Auché [16] to toxic substances elaborated in the body and finally by Partsch [17] to vascular changes.

Speaking of nutritional disturbances, Zimmermann maintained that as a result of the impoverished nutrition, the resistance of the patient is reduced to a point at which he is unable to cope with the effects of the invading organisms. Fortunately this has become a factor of lessened importance, owing to the present stringent dietary and insulin regimentation. Little more can be said of the role played by the sugar in the blood and body tissues. This theory was based primarily on the experimental work of Bujwid, who produced local gangrene by the simultaneous injection of Staphylococcus aureus subcutaneously and of dextrose intravenously. The damage is due in part to the effects of the dextrose itself and otherwise to the influence of the anhydremia. Generally speaking, it is unlikely that infection is favored by a single factor alone; rather, it is probably favored by a combination of factors in the presence of infective agents. These factors may be listed as (1) lowered resistance of the tissues associated with impaired cellular activity, (2) disturbed metabolism resulting from improper assimilation of carbohydrates and (3) vascular deficiencies. Irrespectvie of the modus operandi, the advent of infection spells trouble.

ROLE OF FOCAL INFECTION

On the question of focal infection in these cases there is widespread difference of opinion. It has been my observation that with the exception of acute infection in these foci, the problem does not differ materially from that of the foci in the otherwise healthy person. The indications for the eradication of these foci and the postoperative results show the same variability. Beck,[18] referring to the collective opinions

14. Zimmermann, C.: Ear Affections and Diabetes, Ann. Otol., Rhin. & Laryng. **25**:637 (Sept.) 1916.

15. Naunyn, B.: Der Diabetes mellitus, Vienna, A. Hölder, 1906.

16. Auché, B.: Arch. de méd. expér. et d'anat. path., 1896.

17. Partsch: Berl. klin. Wchnschr., 1890, p. 979.

18. (*a*) Beck, J. C., and Pollock, H. L.: Pathologic Conditions of the Ear, Nose and Throat in Diabetes, Arch. Otolaryng. **5**:400 (May) 1927. (*b*) Beck, J. C.: Diabetes from the Standpoint of the Otolaryngologist, J. Indiana M. A. **21**: (Jan.) 1929.

of Woodyatt, Allen, Von Noorden and Wilder, pointed out that they stressed the importance of focal infection in the sinuses, tonsils and teeth. They stated the conclusion, he said, that these infections have a decided influence on the metabolic disease. Likewise, even partial eradication of these foci sufficed to show prompt improvement and lasting results. Hempstead and Adams,[19] in their study of the case records of 416 patients with proved diabetes, found acute and chronic lesions in 141. Of this number, 62 were operated on, 59 being subjected to tonsillectomy, 1 to paracentesis and 2 to sinus lavage. Those authors expressed the opinion that the underlying diabetes was not improved by the removal of focal infection and that, at the most, progress was lessened in the cases of acute conditions.

CLINICAL MANIFESTATIONS OF INFECTION

The examination of the ear, nose and throat shows no gross findings which may be accepted as pathognomonic of diabetes mellitus. The tissues are fleshy and soft, presenting a spiderweb appearance. There is considerable bleeding on the slightest touch. Garel and Armand [20] made a special study on epistaxis in diabetes and reached the conclusion that it had little significance in spite of its frequent appearance. Kecht and Dibold [21] found the tendency to epistaxis most common between the ages of 20 and 50 years. According to the histologic studies of Hildebrand,[21a] in the absence of more recent investigation, it appears that the hemorrhagic diathesis for the most part is the result of secondary degenerative changes in the newly formed connective tissues of the vascular walls.

Ulceration of the nasal septum is a second common gross finding. Foltz,[22] in 1906, reported on ulceration of the septum and stated that sugar in the blood irritated the vascular walls, producing thickening, occlusion and subsequent ulceration. Lubinski,[23] in 1910, and Trautmann,[24] in 1910, reported cases of diabetes mellitus in which septal abscesses were followed by defects in the cartilaginous septum. Freuden-

19. Hempstead, B. E., and Adams, S. F.: Diabetes in the Practice of Otolaryngology, Arch. Otolaryng. **1**:181 (Feb.) 1925.

20. Garel and Armand: L'épistaxis dans le diabète, Bull. de laryng., otol. et rhin. **8**:276, 1905.

21. Kecht, B., and Dibold, H.: Diabetes und Eiterungen im Mittleohr, Nasennebenhöhlen und Rachen, Ztschr. f. Hals-, Nasen- u. Ohrenh. **39**:288, 1936.

21a. Hildebrand, cited by Kecht and Dibold.[21]

22. Foltz, K. O.: Diseases of Nose and Throat, Cincinnati, Scudder Brothers Company, 1906.

23. Lubinski, cited by Kecht and Dibold.[21]

24. Trautmann, G.: Nasendestruktionen infolge Erkrankungen des Septum mit besonderer Berücksichtigung der Hämatome und Abscesse, Arch. f. Laryng. u. Rhin. **23**:360, 1910.

thal,[25] in 1917, in reporting a case of severe nosebleed in a woman with diabetes mellitus, called attention to the ulceration of the nose and throat.

Sneezing and hypersecretion as symptoms of vasomotor rhinitis are not common.

In relation to the common cold, Wylie [26] emphasized the faulty judgment of deciding on the use of instrumentation in these cases during the height of infection. As a result of the impaired resistance of the tissues, the mere probing of the frontal nasal duct or irrigation of a mild maxillary sinusitis may be sufficient to convert an ordinarily mild infection into a grave process. Extension of the infection from the nose to the sinuses is a similar complicating process. Shemely,[27] in 1922, was among the first to report a case of pansinusitis with unrecognized diabetes as a probable contributing factor. Diabetic patients under proper dietary control are frequently encountered in the outpatient department who improve under conservative treatment with no more alacrity than do the nondiabetic. Kalteyer and Bernstein,[28] in 1933, reported a case of acute pansinusitis with multiple cranial nerve involvement and gave the necropsy findings.

To turn now to the pharynx, Mayer [29] stated that the most common complaint is that of a hot, dry sensation in the throat. This is associated with a highly sensitive but only slightly inflamed mucous membrane. Frequently the gross picture is that characteristic of atrophic pharyngitis, in which permanent pathologic changes have produced dryness of the mucosa. The surface is covered frequently by thin, dry, mucofibrinous crusts. Histologically, the glandular structures have been obliterated and replaced by secondary connective tissue proliferation. Pharyngitis with involvement of the glossopharyngeal nerves was reported by Maru.[30]

The patient suffering from diabetic laryngitis complains of aphonia, dryness and discomfort on phonation. These complaints are associated with such characteristic anatomic changes as are seen in laryngitis sicca. There are noticeable hyposecretion and dryness extending to the trachea.

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25. Freudenthal, W.: Severe Epistaxis in a Woman with Diabetes, Ann. Otol., Rhin. & Laryng. **26**:416 (June) 1917.

26. Wylie, C. B.: Conditions Complicating Diseases of Ear, Nose and Throat, West Virginia M. J. **22**:662 (Dec.) 1926.

27. Shemely, W. G.: Report of a Case of Pansinusitis with Unrecognized Diabetes Mellitus as a Probable Contributing Factor, Hahneman. Monthly **57**:222, 1922.

28. Kalteyer, F., and Bernstein, M.: Pan-Sinusitis (Acute) with Multiple Cranial Nerve Involvement Complicating Diabetes Mellitus: Report of a Case with Necropsy, Eye, Ear, Nose & Throat Monthly **12**:447 (Dec.) 1933.

29. Mayer, B.: Die Beziehungen des Diabetes mellitus zu den oberen Luftwegen, Monatschr. f. Ohrenh. **69**:397 (April); 564 (May) 1935.

30. Maru, J.: Glossopharyngeal Neuralgia Caused by Diabetes Mellitus, Gyógyászat **74**:725 (Dec.) 1934.

The same process eventually involves the vocal cords, producing ulceration and atrophy. Zanni [31] recently reported a case in which ulceration of the epiglottis occurred, while Vinson and Wilder [32] reported one in which there was diffuse ulceration of the trachea.

The frequency of infection in the faucial tonsils permits ample study in cases of that condition. The consensus is that infection in that area in persons with diabetes does not differ appreciably from that seen in the nondiabetic. It has been my observation that infection when acute is characterized by increased duration, and at times simultaneous exacerbation, of the diabetes mellitus. This prolongation of the active infection bears a direct relation to the metabolic equation. I should like to point out the frequent presence of Vincent's infection in these cases.

Diabetes frequently gives rise to symptoms in the ear. Pruritis and autophony are concomitant complaints in chronic eczema of the external auditory canal. The former is more intense and protracted. It is often associated with circumscribed external otitis which heals slowly and is prone to recurrence. Grunert,[33] however, maintained that diabetes does not predispose to this frequent recurrence, as the routine examination in cases of prolonged or recurrent infection failed to disclose an undue incidence of glycosuria.

Of the infections in the ear, acute suppurative otitis media is the most commonly observed. Its relation to diabetes mellitus has been variously appraised. Wolf,[34] in 1887, was first to describe what he designated as a specific diabetic otitis media with extensive necrosis of the mastoid process. To his conclusions was added the theory of Koerner [35] that the infection was of hematogenous origin, extending early to the pneumatic spaces. Later, Grunert [36] observed that although the theories just mentioned were generally discredited, it was certain that the greater vulnerability of the tissues predisposed to more frequent occurrence of acute otitis media and delayed the healing process, producing a greater incidence of chronic suppuration. Grossmann,[37] in 1906, among others, found acute otitis media to result in much greater

31. Zanni, G.: Lesioni diabetiche dell' epiglottide, Arch. ital. di otol. **48**:115 (Feb.) 1936.

32. Vinson, P. P., and Wilder, R. M.: Diffuse Ulceration of Oesophagus and Trachea, Arch. Int. Med. **52**:541 (Oct.) 1933.

33. Grunert, K.: Zur Frage des Vorkommens von Glycosurie in Folge von Otitis, Arch. f. Ohrenh. **55**:156, 1902.

34. Wolf, O.: Verhandl. d. Gesellsch. deutsch. Naturf. u. Aerzte, 1887, vol. 51.

35. Koerner, O.: Arch. f. Ohrenh. **56**:141, 1905.

36. Grunert, K., in Brühl, G., and Politzer, A.: Grundriss und Atlas der Ohrenheilkunde, ed. 2, Munich, J. F. Lehmann, 1905, p. 207.

37. Grossmann, F.: Ueber Mittelohreiterung bei Diabetikern, in Beiträge zur Ohrenheilkunde, Festschrift gewidmet August Lucae zur Feier seines siebzigsten Geburtstages, Berlin, 1905, pp. 353-378.

necrosis and more widespread destruction of the mastoid process in diabetic patients than in the nondiabetic.

Uffenorde,[38] in 1934, asserted that acute otitis media in a patient with this malady is a sequel of the same injurious process as in the otherwise healthy person. Majer's [39] analysis of 35 cases indicated that he shared this opinion. He demonstrated that the course of infection in diabetic patients is identical with that in the nondiabetic. The same applied to the postoperative course, while the mortality rates and the results of mastoidectomy were equivocal.

According to Barth,[40] otitis media in persons with diabetes constitutes approximately 3 per cent of all cases of otitis media. In a group of 30 patients, of whom 29 were subjected to mastoidectomy, the incidence of perisinal abscess was 20 per cent, lateral sinus thrombosis 3.3 per cent and labyrinthitis 10 per cent, and the attendant mortality was 20 per cent. This approached closely the operative mortality of 23.5 per cent reported by Kecht and Dibold [21] for their group of cases, in which there was no attempt made at classification. Of more than usual interest is the incidence of Pneumococcus type III (50 per cent) reported for the cases of Barth.

In contrast to the statistics of the observers already mentioned, those reported by Fraser and Halliday [41] are of special interest. The latter authors studied 2,731 cases of acute suppurative otitis media in otherwise healthy persons. Of these, 35.5 per cent were subjected to mastoidectomy, with the incidence of perisinal abscess being 3.5 per cent and of lateral sinus thrombosis 1.7 per cent and with a mortality of 6.6 per cent. Pneumococcus type III was the etiologic agent in 14 per cent, while the hemolytic and the nonhemolytic streptococcus were recovered in 80 per cent of the cases. Unfortunately the authors failed in each instance to include an adequate discussion of the postoperative course. Similarly no mention was made of the use of sulfanilamide, and the assumption is that this was not employed. Insofar as this comparison may be made, the report of Fraser and Halliday fails to substantiate the roseate observations of Majer. The presence of diabetes mellitus unquestionably is productive of more frequent indications for operative intervention as well as a resultant increase of intracranial complications.

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38. Uffenorde, W.: Diabetes und Mittelohreiterung, Ztschr. f. Hals-, Nasen- u. Ohrenh. **35**:385, 1934.

39. Majer, E. H.: Diabetes und Hals-, Nasen-Ohrenkrankheiten, Wien. klin. Wchnschr. **50**:1581 (Nov. 19) 1937.

40. Barth, H.: Otitis media acuta und Diabetes, Klin. Wchnschr. **16**:198 (Feb. 6) 1937.

41. Fraser, J. S., and Halliday, G. C.: Report on Eight Hundred and Ninety-One Consecutive Cases of Acute Middle Ear Suppuration and Mastoiditis, J. Laryng. & Otol. **51**:619 (Oct.) 1936.

Of the other symptoms, tinnitus, vertigo and progressive loss of hearing are common in diabetes mellitus. These are associated with involvement of the inner ear. According to Edgar,[42] in 44 per cent of these cases diabetes mellitus is the sole cause, resulting in degenerative neuritis of the cochlear nerve, or toxic neurolabyrinthitis. Recently Hart [43] substantiated the conclusions of Edgar, adding that the changes were the result of toxins in the blood stream or sclerotic changes in the nutrient vessels.

PROTRACTED WOUND HEALING

Reference has been made to delayed healing of wounds in these cases. Majer refuted the belief that there followed a protracted period of healing. However, the patient whose history forms the basis of this study presents two fistulas after approximately one year of conservative treatment. In the past this delay has been attributed purely to a poor defensive mechanism, characterized by diminished phagocytosis and poor cellular response.

Kecht and Dibold,[21] quoting Barwich and Haardt, stated that the poor healing results from the increase of cholesterol in the blood and body tissues. Hyperglycemia, glycosuria and acetonuria are common findings. Their degree has no direct relation to the sluggish healing of wounds. Protracted healing and even fatal termination occur more frequently not in the young diabetic patients with marked acidosis but in the older ones with little or no acetonuria. In these cases in which acetonuria or acidosis develops, it occurs later in the course of the infection and is the result, rather than the cause, of the infection. All other factors being equal, it seems that the status of the vascular supply is the determining factor in the rapidity of wound healing. Hypertension with concomitant arteriosclerosis is so frequently seen in the older group of patients that the development of that condition is frequently attributed to diabetes. While the influence of the vascular structures is undeniable, one must not lose sight of the roles played by the secondary factors in this vicious cycle.

INDICATIONS FOR OPERATION

What is to be done surgically with these patients is often a vexing problem. Generally speaking, all the principles of good surgery are applicable here. Nevertheless, owing to the altered conditions imposed by the disturbed metabolism, each surgical procedure must be brief and must not inflict excessive trauma. The unfavorable results of surgical intervention follow psychic shock, trauma and the deleterious effects of

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42. Edgar, T. O.: Klinische Untersuchungen uber die Erkrankungen des Gehörorgans bei Diabetes mellitus mit besonderer Berücksichtigung der Erkrankungen des inneren Ohres, Monatschr. f. Ohrenh. **49**:225, 1915.

43. Hart, V. K.: Ear Manifestations in Diabetes, Ann. Otol., Rhin. & Laryng. **41**:1142 (Dec.) 1932.

the production of anesthesia and narcosis. These results are manifested by glycosuria, acidosis, weakness and cardiac failure.

Mild, severe or intermediate diabetes requires complete medical study, before, during and after operation. This close supervision, supported by administration of insulin, is of the utmost importance, having as the prime purpose (1) reducing the hyperglycemia, (2) avoiding acidosis and (3) preserving the strength of the patient. The indications for urgent surgical procedure are few and may be enumerated as follows:

1. Marked acidosis accompanied by spreading infection.

2. Increased acetonuria associated with suppuration.

3. Infection of such a nature or location that it may lead to coma even when the blood sugar content is satisfactory.

4. In the presence of infection, a metabolic picture, as presented by the blood sugar index, which both insulin and diet have failed materially to alter.

When the patient is a poor surgical risk or cannot be adequately prepared for operation, limited surgical intervention is desirable.

In the group of cases in which surgical procedure is mandatory but not urgent, there is no excuse for operation in the absence of optimum conditions. Guided by the general principles outlined, surgical intervention may attain the same completeness in the diabetic as in the nondiabetic patients. It might be well to bear in mind the contention of Seydell,[44] that operative intervention may be delayed or dispensed with by the timely use of insulin and dietary regulation. This lessens the dangers attendant on the production of general anesthesia. The primary consideration is the safety of the patient, and, as pointed out by Hirsch,[45] the diabetes mellitus is to be treated first and surgical intervention is to follow later. This program must be carried out in spite of the deleterious influence which suppurative otitis media, sinusitis and peritonsillitis exert on the metabolic condition. There is no valid reason for the initial removal of the suppurative lesion in these cases, as has been advocated by von Noorden and Isaac.[46]

The use of local anesthetic agents is to be avoided whenever possible, owing to the danger of traumatism and shock. Ether appears the least harmful of the anesthetic agents in common use.

When surgical intervention is elective the same routine is indicated. Operations of this type are beset with the same inherent dangers. It must be remembered that although the primary object is not the removal

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44. Seydell, E. M.: Mastoiditis in Diabetes Complicated with Diabetic Facial Paralysis, Ann. Otol., Rhin. & Laryng. **35**:181 (March) 1926.

45. Hirsch, C.: Zur Behandlung diabetischer Ohrenkrankheiten, Ztschr. f. Hals-, Nasen- u. Ohrenh. **29**:250, 1931.

46. von Noorden, C., and Isaac, S.: Zuckerkrankheit und Ihre Behandlung, ed. 8, Berlin, Julius Springer, 1927, pp. 84 and 329.

of infection but rather the elimination of obstruction, infection frequently exists in these cases.

I wish to add to the records already in the literature the following report of a case of gangrene of the intranasal structures in a person with diabetes mellitus.

REPORT OF CASE

History.—H. C. a white man 25 years of age, was admitted to the services of Dr. Ivy and Dr. Beardwood in the Graduate Hospital of the University of Pennsylvania on May 11, 1938.

The present illness dated back to April 1, 1938, when the patient noticed a swelling and inflammation at the bridge of the nose. There was no history of antecedent trauma or furunculosis. The swelling was spontaneous, although he admitted that he had been feeling tired, weak and thirsty for some weeks. He was admitted April 11, in coma, to the Newcomb Hospital, Vineland, N. J., with a blood sugar content of 660 mg. per hundred cubic centimeters. After a stormy course the coma abated, and on May 9 the blood sugar value was 185 mg., and the hemoglobin content, which had been 85 per cent on admission, had dropped to 55 per cent, while the erythrocyte count, which had been 4,000,000, had dropped to

Fig. 1.—Photograph of patient on admission, showing widespread edema and erythema at the root of the nose.

2,700,300. During this time the leukocytes remained normal in distribution. This condition was accompanied, however, by an extension of the cellulitis over the right side of the face and into the nose, with involvement of a small area over the hard palate.

The past history was irrelevant except for two facts: (1) that when the patient was a child, although head colds did not occur frequently they were preceded in each instance by severe epistaxis, and (2) the patient first learned that he had diabetes in March 1934, when he consulted his family physician because of weakness and polyuria; he followed the routine dietetic and insulin regimen for six months, and then, feeling much better, discontinued treatment until the onset of the present illness.

Examination.—When first seen the patient did not appear acutely ill. He had no fever. He was breathing through his mouth and showed definite signs of nasal obstruction. The nose was the site of widespread edema and redness, centered over the bridge and extending downward over the right side to the cheek. The right naris was almost completely closed. Both nares contained a profuse, foul-smelling, green, cheesy discharge. The anterior portion of the cartilaginous septum was completely eroded. The mucosa covering the right middle and the inferior turbinate was boggy and blue-black. The pharynx was not injected.

Likewise there were no signs of postnasal discharge. The right side of the soft palate presented a distinct impairment of motility. The anterior cervical lymph nodes on the right side and the submaxillary gland on the left side were enlarged but not tender. The results of the rest of the examination were essentially negative.

Examination of the blood showed the hemoglobin content to be 48 per cent, the erythrocyte count 3,280,000 and the leukocyte count 7,900, with neutrophils 69 per cent, lymphocytes 29 per cent, basophils 1 per cent and monocytes 1 per cent.

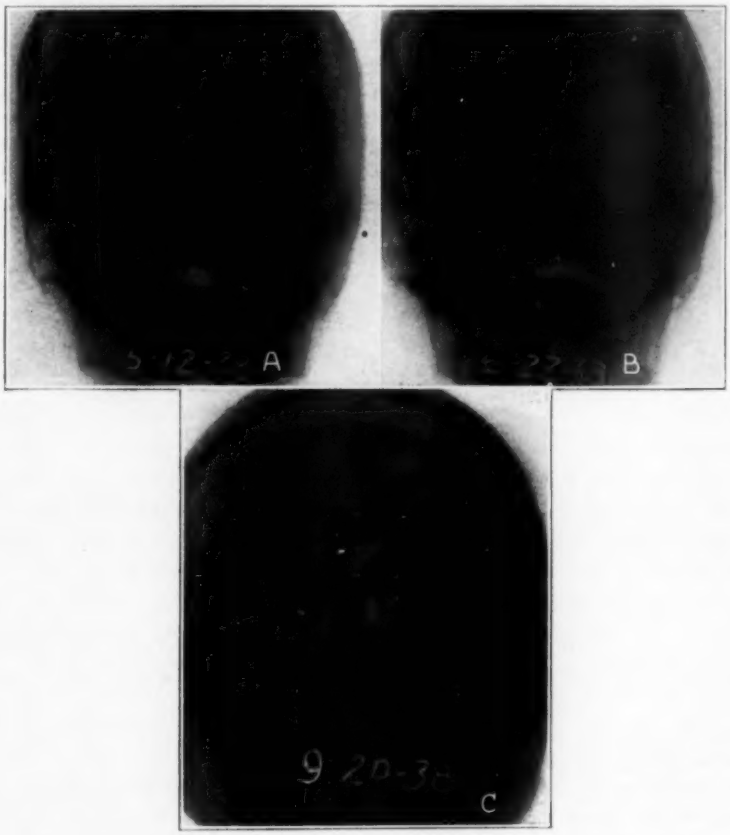

Fig. 2.—Roentgenograms of the patient: *A*, twenty-four hours after admission, showing diffuse clouding of the frontal sinuses with a fluid level in the midline, as well as marked clouding of the ethmoid cells and demineralization of the superior portion of the lateral wall of the right orbit; *B*, after perforation of the skin by the nasal bones, showing marked increase in destruction of the nasal bones, of the nasal process of the frontal bone, and of the ethmoid cells, as well as involvement of the right maxillary sinus, and *C*, five weeks after the patient's discharge from the hospital, showing complete destruction of the perpendicular plate of the ethmoid bone and partial loss of the nasal bones. The ethmoid cells have been destroyed entirely.

The value for urea nitrogen was 11 mg., for chlorides 532 mg., and for blood sugar, 107 mg. per hundred cubic centimeters. The blood sedimentation rate was 66 mm. Reactions to the Wassermann and the Kahn test were negative.

A culture of the nasal discharge gave a growth of nonhemolytic streptococcus, Staphylococcus albus and diphtheroids. The blood cultures were negative.

The urine showed a slight trace of albumin, 8.1 per cent sugar, no acetone or diacetic acid and many hyaline and a few waxy casts.

The roentgenograms revealed a diffuse clouding of the frontal sinuses with a fluid level at the midline. The ethmoid cells showed a marked clouding bilaterally and obliteration of the cell outlines. The changes were most marked on the right side, where there were some haziness and demineralization of the superior portion of the lateral wall of the orbit. The maxillary sinuses showed a slight mucosal thickening, while the sphenoid sinuses were normal.

Course.—On May 14 the patient was transferred to the otorhinologic service of Dr. George M. Coates, and a tentative diagnosis was made of low grade bilateral

Fig. 3.—Photograph made nine months after the patient's discharge from the hospital, showing a residual fistula.

frontal sinusitis, bilateral purulent ethmoiditis and localized acute osteomyelitis of the superolateral margin of the right orbit.

An external incision was made at the inner canthus of the right eye. The opening in the lateral nasal wall was probed and "through and through" drainage established by the inserting of plain gauze packing saturated with mercurochrome. This treatment was followed for a twenty-four hour period by a continuous hot application of magnesium sulfate. This was subsequently changed to hourly applications, which continued for thirteen days. Nasal drainage was facilitated by the use of neo-synephrin four times daily during this period.

On May 22, eleven days after admission of the patient to the hospital, it was decided to discontinue the gauze drainage. The entire bony septum appeared as a pultaceous, necrotic, edematous mass. Five days later, several pieces of necrotic tissues were recovered through the wound opening and the nares. The external edema and swelling had subsided somewhat. The foul odor of the discharges was also lessened as the result of the fact that the wound and the nasal chambers had been packed with silver oxide ointment which had been allowed to remain for forty-

eight hours. Resort was made to the use of the bacteriophage, but with slight change. The patient showed little improvement, and on June 14 two large bony sequestrums were removed from the lateral nasal wall on the right side. At this time the patient had no support to the nose, other than the nasal bones above, the lower edges of which could be seen and palpated. By June 22 the sharp lower edges of the nasal bones had broken through the skin and formed two small fistulas.

Reexamination by roentgenograms showed a marked increase in the destruction of the nasal bones and of the nasal process of the frontal bone. There was an increased destruction of the ethmoid cells. At this time, marked maxillary sinusitis on the right side was also noted. While the frontal sinuses were more densely clouded, no fluid level was seen. The patient showed no improvement, and it appeared unlikely that he could survive the type of operation needed to abate the infection.

On July 26 the right inferior turbinate, middle turbinate and ethmoid structures were removed without difficulty by Dr. S. R. Skillern, Jr. Immediately the general condition began to improve, and within one week the nasal discharge disappeared.

The patient was dismissed from the hospital on August 12 with the diabetes mellitus standardized, the blood sugar content being 159 mg. He received 60 units of protamine zinc insulin daily in divided doses. The subsequent course has been uneventful, with the patient continuing under observation in the outpatient department of both the metabolic and the rhinologic service.

SUMMARY

A case of diabetes mellitus associated with gangrene of the intranasal structures, in which recovery occurred, is reported, the literature is reviewed and clinical manifestations and surgical considerations are discussed. The reported case demonstrates the close association between gangrene and infection, the extension of the infection from the soft tissues to the osseous structures by contiguity and the production of acute localized osteomyelitis being shown, as well as the spread of infection to the vascular channels, resulting in arteritis, phlebitis, thrombosis, occlusion and gangrene. The literature shows the delayed healing of wounds to be the result of changes in the vascular structures and of poor defensive mechanism. The importance of the role of the latter factor was substantiated in the reported case by the poor cellular reaction, the patient showing relative or absolute leukopenia during hospitalization.

Gangrene limited to the intranasal structures is not invariably fatal. The lesion in that area is in this respect in contrast to that occurring on the superficial aspect of the face and cheeks, where the abundant vascular supply facilitates the spread to the venous channels, producing cavernous sinus thrombosis, or to the systemic circulation, producing septicemia or metastatic abscesses.

The prognosis is dependent on many factors, for example the type of infection, location of the primary lesion, status of the vascular supply, general condition of the patient and, finally, intelligent conservative treatment.

DEVELOPMENTAL EXTENSION OF AN ANTERIOR ETHMOID CELL WITHIN THE FRONTAL SINUS

REPORT OF A CASE

HAROLD I. LILLIE, M.D.
AND
KINSEY M. SIMONTON, M.D.
ROCHESTER, MINN.

Unusual pathologic conditions of the frontal sinus are more safely approached by adequate exposure of the interior of the sinus, afforded by an external operation, than by other methods. The improvement in methods described over the past twenty-five years has caused surgeons to be less hesitant in utilizing suitable operative intervention. Employment of such methods has resulted in much increase in knowledge of pathologic conditions and has brought about greater relief to patients.

The report of a bone cyst or ethmoid cell within the frontal sinus, which caused the patient constant, dull headache, is here presented.

REPORT OF CASE

A man aged 40 came to the Mayo Clinic on May 10, 1939, complaining of abdominal discomfort and headaches. The history revealed that he had suffered an attack of acute frontal sinusitis, with external swelling on the right side, ten years previously. This condition had been relieved by an intranasal operation. About a year later he had noted a constant dull ache over the left eye, not severe enough to interfere with his work. An intranasal operation had relieved the pain for two years. The pain had recurred in the same location and had persisted. Occasional relief would be afforded after a gush of straw-colored discharge from the left nostril. The headache was described as "a constant, dull sense of weight over the left eye." During the year prior to examination the patient had suffered about six attacks of severe, prostrating headache, accompanied by nausea of a day's duration. These headaches began in the frontal region and extended to the vertex and back of the head. On some occasions, codeine had been administered for their relief. The nose had not discharged except for the gushes previously mentioned. The patient had a sense of stuffiness in the nose but no actual obstruction to nasal breathing. There were no complaints referable to the ears or throat.

General physical examination and laboratory and roentgenologic studies did not reveal any evidence of organic disease in the abdomen. Examination of the nose showed evidence of previous surgical intervention. The ethmoid cells had been opened and the middle turbinate processes removed; the sphenoid sinuses

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From the Section on Otolaryngology and Rhinology, the Mayo Clinic.

were open, and the nasofrontal ducts had been enlarged, so that they easily admitted a probe on either side. Openings to the antrums were not found. There was a dense fibrous adhesion between the septum and the region of the anterior attachment of the left middle turbinate bone. No secretion was seen in the nose

Fig. 1.—Roentgenogram of the frontal sinuses.

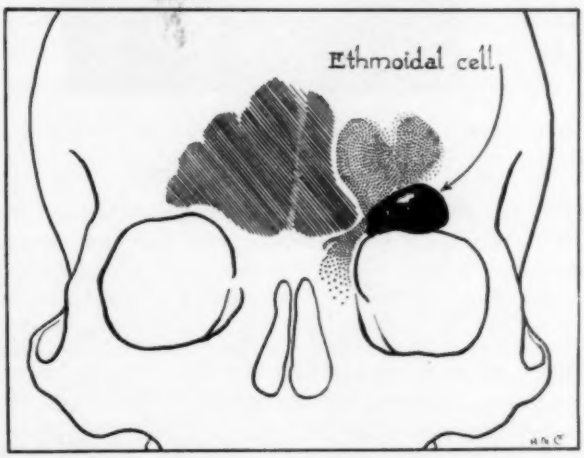

Fig. 2.—Diagrammatic representation of the bone cyst in the left frontal sinus.

on repeated observations. The nasal mucous membranes were of normal appearance. Slight tenderness over the left frontal sinus persisted during the period of observation. Release of the adhesion did not relieve the headache. Results

of examination of the ears and throat were negative. The tonsils had been removed.

Roentgenograms of the paranasal sinuses revealed generalized clouding of all the sinuses. The right frontal sinus extended beyond the midline to the left. The left frontal sinus was densely clouded. The intersinus septum dipped into the left frontal sinus in such a manner as to produce a "bottle neck" in the left nasofrontal duct (fig. 1).

Because it was felt that a mucocele within the frontal sinus caused the symptoms, external exploration of the left frontal sinus was advised. It was performed on May 19, 1939. The lining membrane of the sinus was markedly thickened. A bone cyst was found in the lateral portion of the sinus and was removed in toto. The attachments of the cyst were not determined (fig. 2). The intersinus

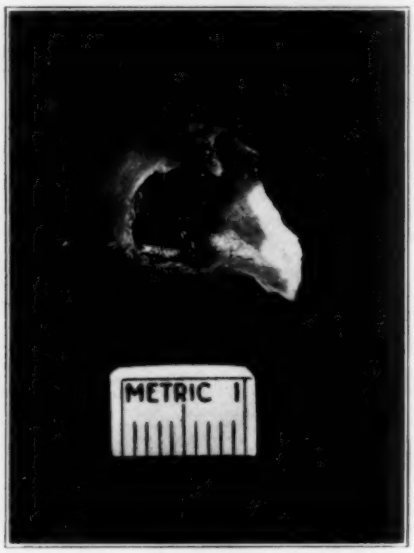

Fig. 3.—Photograph of the gross specimen of the bone cyst removed from the frontal sinus.

septum bulged forward into the left sinus and was broken through, the right frontal sinus thus being exposed. A large nasofrontal duct was fashioned, and the external wound was closed.

Convalescence was uneventful. There was a minimal discharge from the frontal sinus, and the dull aching pain was not felt after the operation. While under observation, the patient experienced two severe migraine headaches. Both were promptly relieved by injection of 0.5 mg. of ergotamine tartrate. The patient was dismissed from the clinic on June 6, 1939.

After dismissal the patient complained of diplopia, which occurred especially when he was fatigued. Objects were placed vertically. This symptom persisted for six months. Gradual improvement took place. In August 1939 the dull headache in the region of the left frontal sinus recurred. It was relieved by the patient's home physician, who inflated the sinus, causing a plug of mucus to be expelled.

The patient returned for observation on Nov. 29, 1939. At this time he had experienced no headache for six weeks. The nasofrontal duct on the left was

open, and the frontal sinus contained no discharge. A band of adhesions which partially blocked access to the nasofrontal duct was removed. Examination of the eye at this time revealed normal muscular balance, although the patient complained of diplopia when the eyes were held at the limit of lateral deviation.

The cyst removed at operation was a thin, hollow shell of bone approximately 2 cm. long, 1.5 cm. wide and 1 cm. deep (fig. 3). It was open at the point of attachment, but not at any other place. Microscopic examination showed it to be composed of bone of orderly cellular arrangement with well developed haversian canals. The inner aspect of this cyst was lined by a continuous membrane of low cuboidal cells, and the outer aspect retained patches of cells of similar appearance. No cilia were noted on any of these cells. The arrangement of the cells suggested epithelium, although the cells were not typical. The presence of round cells suggested the effect of chronic inflammation (fig. 4).

Comment.—The cystlike osseous structure in the frontal sinus was a pathologic condition which had not been previously observed at the Mayo Clinic. It was our opinion that the structure represented an

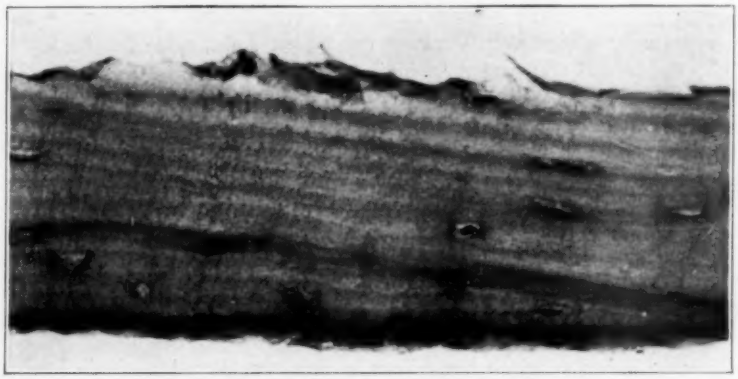

Fig. 4.—Photomicrograph of the section from the bone cyst taken from the frontal sinus (hematoxylin and eosin; × 400).

anterior ethmoid cell which had grown upward into the frontal sinus. A desire to understand the origin and significance of this structure led to a review of the literature on the subject. Search of the *Index Medicus* and of the "Index-Catalog of the Library of the Surgeon General's Office" was made, without reference being found to this subject by title. The available textbooks were reviewed. Schaeffer [1] mentioned that the frontal sinus in some instances develops from the recessus frontalis. He wrote:

The various outpouchings from the recessus frontalis continue to extend their boundaries, and the one destined to form the frontal sinus (if the frontal recess

1. Schaeffer, J. P.: The Nose, Paranasal Sinuses, Nasolacrimal Passageways, and Olfactory Organ in Man: A Genetic, Developmental, and Anatomico-Physiological Consideration, Philadelphia, P. Blakiston's Son & Co., 1920.

is the source) ultimately comes in contact with the horizontal portion (pars orbitalis) of the frontal bone, and up to this time the mucous-membrane sac has a thin, compact bone matrix. Extension into the horizontal portion of the frontal bone now follows, thence between the tables of the vertical portion (squamous frontalis), by the simultaneous growth of the sinus and resorption of the cancellous bone.

This statement raised the question of the structure as being an embryologic rest from the bone matrix accompanying the upward extension of the recessus frontalis. Photographs of the specimen and a microscopic slide were sent to Dr. Schaeffer for his opinion.

Dr. Schaeffer [2] replied as follows:

It is my opinion that the cystlike structure which you encountered in the lateral aspect of the left frontal sinus was, in reality, a frontal anterior ethmoid cell which had ballooned frontalward into the floor of the frontal sinus. The walls of such bleblike ethmoid cells become extremely thin, the cells often encroaching on the nasofrontal connections, practically occluding the normal drainage channel of the frontal sinus. Occasionally one sees specimens of this sort in which the ethmoid cell is almost wholly within the frontal sinus, connected by a slender stalk with the frontal recess of the middle nasal meatus, the point of origin of the ethmoid cell in question. Should the lumen of the frontal sinus be exposed, such a frontal ethmoid cell could readily be shelled out. Fig. 118, page 153, of my book on "The Nose, Paranasal Sinuses, Nasolacrimal Passageways, and Olfactory Organ in Man," illustrates, in a measure, what I am attempting to describe. In the specimen shown, the nasofrontal connections were very much encroached on.

The microscopic slide which you submitted shows sections of extremely thin bone not unlike those which one encounters in these bullous-like frontal anterior ethmoid cells. The cells covering both surfaces of the thin, shell-like bone are quite atypical, and they are difficult to explain, unless, perhaps, the normal epithelium has become greatly modified because of pressure. Again, one thinks of a chronic sinus infection which may have profoundly altered the cell membrane lining, both of the frontal sinus and of that within the ethmoid cell. At places the surface covering of the thin bone suggests an inflammatory exudate.

No other mention of the subject was found in the literature. Our final conclusion is that this structure represents an anterior ethmoid cell situated within the lumen of the left frontal sinus.

COMMENT

The anomalous development of the frontal sinuses of this patient produced a long, narrow and tortuous passageway from the left frontal sinus to the nose. In addition, an anterior ethmoid cell had grown mushroom-like into the lumen of the frontal sinus in such a manner as further to inhibit free ventilation and drainage of the sinus. This anatomic arrangement made chronic inflammation almost a certain eventuality should the sinus become infected, with the formation of a mucocele

2. Schaeffer, J. P.: Personal communication to the authors.

or pyocele an extremely likely occurrence. The case demonstrates the role of the anatomic structure in determining the pathologic process to be found in a given sinus and the necessity of considering both anatomic and pathologic aspects in planning a surgical approach which will successfully relieve the disease process.

The clinical course in this instance closely follows that which might be inferred on the basis of the structure of the part. The primary acute infection subsided without surgical intervention on the left side. One year later, symptoms of mild pressure appeared, which were relieved by intranasal enlargement of the nasofrontal duct. The futility of attempting to create an adequate drainage pathway through a long and tortuous duct is demonstrated by the recurrence of symptoms two years after operation, in spite of the fact that the nasofrontal duct readily admitted a probe and in spite of a periodic gush of secretion from the cavity of the sinus. Erosion of the walls of the frontal sinus by the formation of a true mucocele had not occurred. The external approach to the sinus made possible removal of the misplaced anterior ethmoid cell as well as of the intersinus septum, both of which had contributed greatly to the impaired drainage of the frontal sinus. Relief of symptoms scarcely could have been expected had not external exploration of the frontal sinus been employed.

NEOPLASMS INVOLVING THE MIDDLE EAR

HARRY ROSENWASSER, M.D.
NEW YORK

Many years ago it was rather generally believed that the diagnosis of a malignant growth involving the middle ear once having been established, the prognosis was uniformly hopeless. Before the advent of modern radiotherapy and electrocoagulation the earlier literature abounds with reports such as those of Schwartze,[1] Toynbee,[2] Wilde,[3] Pomeroy[4] and others, who expressed the opinion that operation seemed to accelerate the rate of growth of the neoplasm. After this, there was an era characterized by reports such as those by Kretschmann[5] and others, who stated the belief that aural neoplasms should be operated on not because a cure could be effected but because relief of pain and diminution in the amount of foul-smelling discharge frequently resulted. The attitude toward the treatment of neoplasms involving the middle ear and mastoid bone has entered what may be termed a third stage, in which the conclusion has now been stated (by Holmgren,[6] Öhngren,[7] Berven,[8] Thorell,[9] Fraser,[10] Pfahler,[11] Schall,[12] Milligan,[13] Beck[14] and many

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From the Otologic Service of Dr. Jacob L. Maybaum, the Mount Sinai Hospital.

1. Schwartze, H.: Fall von primärem Epithelial-Krebs des Mittelohres, Arch. f. Ohrenh. **9**:208-219, 1875.

2. Toynbee, J.: The Diseases of the Ear: Their Nature, Diagnosis and Treatment, London, H. K. Lewis, 1868, p. 392.

3. Wilde, W. R. W.: Practical Observations on Aural Surgery and the Nature and Treatment of Diseases of the Ear, London, John Churchill, 1853.

4. Pomeroy, O. D.: The Diagnosis and Treatment of Diseases of the Ear, New York, Birmingham & Co., 1883, p. 302.

5. Kretschmann, F.: Ueber Carzinome des Schläfenbeines, Arch. f. Ohrenh. **24**:231-262, 1886.

6. Holmgren, G.: Die Diathermie-Behandlung der bösartigen Tumoren der Nasennebenhöhlen, der Nase und Nasopharynx, in Internationale Kongress Oto-Rhino-Laryngologie, Copenhagen, Imprimerie Krohn Knippels Brogad, 1928, pp. 302-335.

7. Öhngren, G.: Malignant Tumors of the Maxillo-Ethmoidal Region: Clinical Study with Special Reference to Treatment with Electro-Surgery and Irradiation, Acta oto-laryng., 1933, supp. 19, pp. 1-476.

8. Berven, E.: The Technique in the Treatment of Tumors at Radiumhemmet, Stockholm, Acta radiol. **10**:3-48, 1929.

9. Thorell, I.: Malignant Tumors of the Middle Ear at Radiumhemmet, Stockholm, Acta radiol. **16**:242-253, 1935.

others) that the combined form of radical surgical and irradiation therapy offers a much better prognosis than any of the earlier methods of treatment.

Within recent years some rather interesting patients were referred to the Mount Sinai Hospital and outpatient department, whose conditions were tentatively diagnosed as chronic suppuration of the middle ear associated with what were described as "aural polypi" in the external auditory canal. A large proportion of these lesions proved to be polypi accompanying prolonged aural discharge and infected cholesteatoma. Others, however, were not, and it is with these exceptions, notably a carcinoma, an adenocarcinoma, a fibrosarcoma and a neurofibroma, that this communication is concerned. In but 2 of the 4 cases, those of the carcinoma and the neurofibroma, was there a history of prolonged suppuration of the middle ear. In all 4 cases, however, paralysis of the facial nerve or palsy was a presenting sign on admission. The importance of determining the nature of the underlying process before any form of therapy is contemplated cannot be overemphasized.

Incidence.—According to the reports in the literature (table 1), the incidence of neoplasms involving the middle ear and mastoid varies considerably.

At the Mount Sinai Hospital the experience in regard to the incidence of neoplasm of the middle ear has been unusual: In 1932 there was 1 case, that of a squamous cell carcinoma involving the middle ear and mastoid. No patients with neoplasm involving the middle ear were encountered thereafter until 1936-1937, during which time 3 such patients were observed; the lesions of these patients included an adenocarcinoma, a neurofibroma and a fibrosarcoma. During this entire period (1932 to 1937) there were approximately 20,000 patients admitted to the hospital and outpatient department, indicating an approximate incidence of 1 : 5,000. All the patients were 50 years of age or over.

It is my opinion that the apparent variability in the incidence, as noted in table 1, is merely coincidental. The scarcity of reports in the literature may be explained by the fact that isolated cases of aural neoplasm often are not reported. Possibly the diagnosis is missed in many instances. More conditions are recognized early if polypi asso-

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10. Fraser, J. S.: Malignant Disease of the External Acoustic Meatus and Middle Ear, J. Laryng. & Otol. **45**:636-643, 1930.

11. Pfahler, G. E.: Electrocoagulation and Radiation Therapy in Malignant Diseases of Ear, Nose and Throat, J. A. M. A. **85**:344-347 (Aug. 1) 1925.

12. Schall, L. A.: Neoplasms Involving the Middle Ear, Arch. Otolaryng. **22**:548-553 (Nov.) 1935.

13. Milligan, W.: Diathermy in Inoperable Carcinoma. Acta oto-laryng. **7**: 604-608, 1924-1925.

14. Beck, J. C.: Malignancy in Otolaryngology, Ann. Otol., Rhin. & Laryng. **37**:263-274, 1928.

ciated with prolonged suppuration of the middle ear are studied histologically, a point emphasized by Newhart [15] in 1917. There are instances, however, of neoplasm involving the middle ear, in which the condition is not associated with a history of prolonged otorrhea, as shown by cases 2 and 3 of the present series. To paraphrase this, it is advisable to perform a careful biopsy in any suspicious case in which there is a mass in the tympanum or obscuring the tympanum, whether there is aural discharge or not, even before the development of severe pain or paralysis of the facial nerve.

TABLE 1.—*Incidence of Neoplasms of the Middle Ear*

Author	Place and Time of Observation	Neoplasms of the Middle Ear	Total Number of Patients Admitted	Approximate Rate of Incidence
Richter, H.: Ztschr. f. Hals-, Nasen- u. Ohrenh. **31:** 169-192, 1932	Erlangen Clinic, Germany (1919-1931)	2	35,000	1: 10,500
Junod, A.: Schweiz. med. Wchnschr. **52:** 510-514, 1922	University Clinic, Basel, Switzerland (25 yr.)	6	45,000	1: 7,000 to 1: 8,000
Gerber: Ztschr. f. Ohrenh. **45:** 69-74, 1903	Poliklinic, Königsberg, Germany	..	.....	1: 5,000 to 1: 10,000
Furstenberg, A. C.: Ann. Otol., Rhin. & Laryng. **33:** 677-689, 1924	University of Michigan Hospital	2	40,000	1: 20,000
Schall [12]	Massachusetts Eye and Ear Infirmary, Boston	15	90,040	1: 6,000
Robinson, G. A.: Laryngoscope **41:** 467-473, 1931	Manhattan Eye and Ear Infirmary, N. Y. (1905-1924)	48	212,000	1: 4,000* 1: 42,000
Fraser [10]	Royal Infirmary, Scotland	15	6,605	1: 4,400
Bezold, F.: Ztschr. f. Ohrenh. **33:** 152, 1918		1	20,000 (3, external canal)	1: 20,000

* Including tumors of the auricle.

REPORT OF CASES

CASE 1.—V. K., a woman aged 56 years, was admitted to the otologic service of Dr. Friesner complaining of bilateral intermittent foul-smelling otorrhea for forty-six years, paralysis of the left side of the face for one week and pain in the left ear for two weeks. The patient had measles during childhood, and since then there has been an intermittent discharge from both ears. She never previously had headache, chills, fever or pain associated with the otorrhea. There was a definite impairment of hearing on the left side.

Three weeks before admission to the Mount Sinai Hospital, the patient had a "cold." The left ear discharged more profusely and felt "full," and tinnitus became marked. One week later severe pain developed in and in front of the left ear. The pain increased steadily and was much worse at night. Twitching of the left side of the face occurred ten days before admission to the hospital, and after three days there was complete paralysis of the left facial nerve. The hearing

15. Newhart, H.: Primary Carcinoma of the Middle Ear: Report of Case, Laryngoscope **27:**543-555, 1917.

in the meantime had become progressively worse, There was no vertigo or other symptoms referable to the right ear.

Examination of the left ear revealed a large granuloma filling the depths of the auditory canal. There was a thin, pulsating discharge. The patient could hear a loud shout when the Bárány noise apparatus was inserted into the right canal. Spontaneous horizontal nystagmus was present to the right and left. There was complete left peripheral paralysis of the facial nerve. The Wassermann reaction of the blood was negative. Because the patient had what appeared to be a severe indurative type of external otitis, radical mastoidectomy was temporarily deferred. The external otitis proved unyielding to all the usual methods of treatment. The

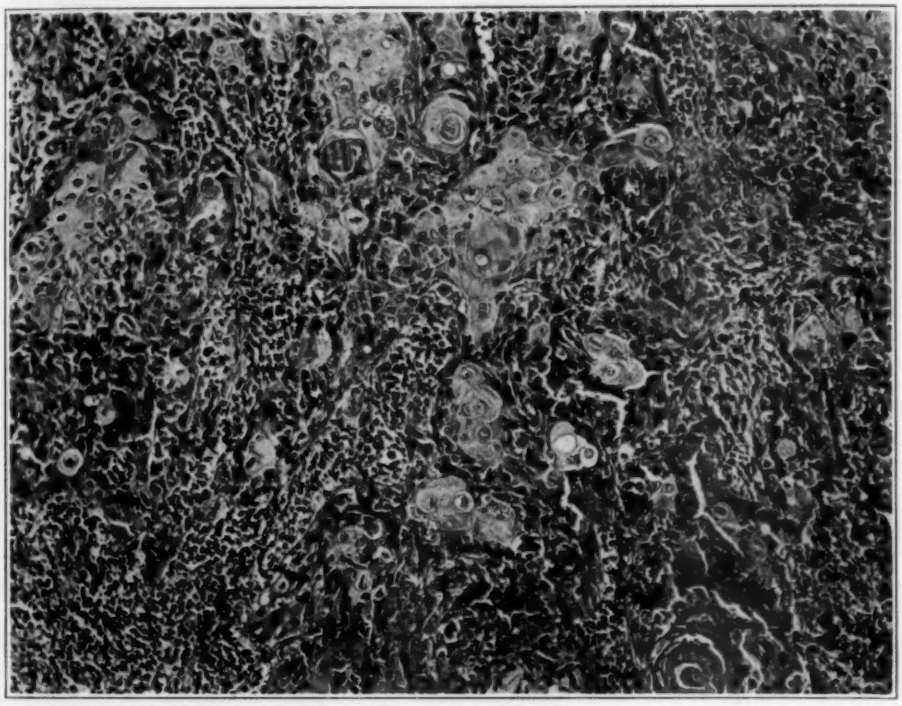

Fig. 1.—Section showing invasion by squamous cell carcinoma.

tendency of the granuloma to bleed readily when touched, the paralysis of the facial nerve, the intractable pain and the long-standing suppuration of the middle ear, prompted the diagnosis of a neoplasm.

Radical mastoidectomy was performed. A grayish homogeneous soft tissue mass filled the middle ear, aditus and antrum, invading the fallopian canal and the region of the stapes. The dura was adherent to the tumor tissue. After histologic examination, the tissue removed was reported to be squamous cell carcinoma (fig. 1).

Postoperative Course.—The patient did poorly. The wound was left open wide and revealed considerable local necrosis. The pain and paralysis of the facial nerve were unchanged, and fever persisted. The patient was treated by Dr. William Harris with small doses of roentgen therapy as a preliminary measure to clear

up the infection and then with intensive irradiation. One month after the operation, however, the patient died.

Autopsy.—Postmortem examination revealed adhesions between the tegmen tympani and the under surface of the temporal lobe. Adjacent to the adhesions, there was a defect in the tegmen tympani, through which the tumor spread into the substance of the temporal lobe. On separation of the adhesions between the brain and the superior surface of the petrous pyramid, there was an escape of foul greenish pus from the substance of the temporal lobe. The histologic sections of the mastoid and petrous pyramids indicated carcinomatous invasion of the cochlea as well as beginning sequestration (fig. 2).

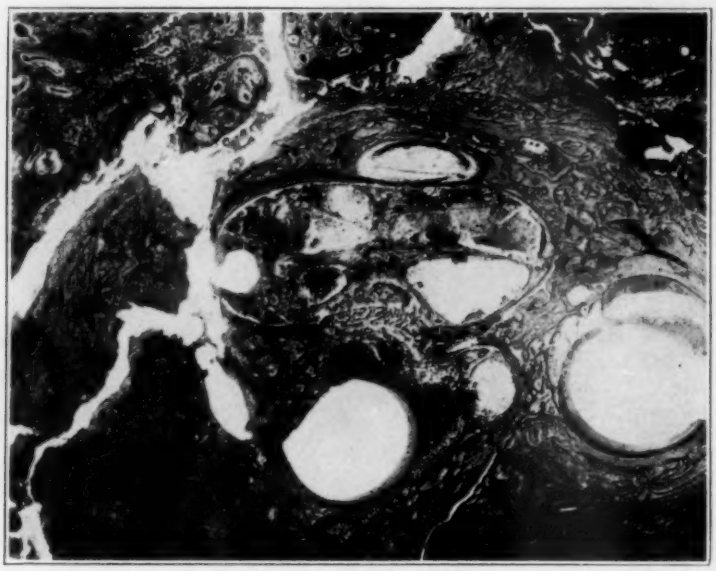

Fig. 2.—Section showing sequestration of the cochlea and invasion by the carcinoma of the cochlea.

Comment.—The salient features which were helpful in the diagnosis of neoplasm were (1) the intractable external otitis together with induration of the auricle which resisted every form of therapy, a condition mentioned by Voislawsky[16] in 1905 in his excellent paper on the subject, as well as by Robinson;[17] (2) the tendency for the tympanic granuloma to bleed profusely despite painstaking care to avoid trauma, a characteristic of malignant tumors mentioned as far back

16. Voislawsky, A. P.: Tumors of the Ear, Ann. Otol., Rhin. & Laryng. **14**: 768-781, 1905.

17. Robinson, G. A.: Malignant Tumors of the Ear, Laryngoscope **41**:467-473, 1931.

as 1884 by Moos;[18] (3) the occurrence of paralysis of the facial nerve, and (4) the severe pain, especially at night, a common symptom of carcinoma involving the middle ear. The report of the biopsy verified the diagnosis. The pathologic specimen in this case showed widespread extension into the temporal lobe by the tumor, with secondary infection

TABLE 2.—*Analysis of Four Cases of Neoplasm Involving the Middle Ear*

Case; Age, (Yr.); Sex	Diagnosis	Symptoms on Admission; Duration Up to Admission	Treatment	Result	Postmortem Findings
1. V. K. 56 F	Squamous cell carcinoma	Otorrhea 46 yr. Facial paralysis: 1 wk. Pain: 2 wk. Deafness, complete: long time	Radical mastoidectomy; irradiation to control infection; massive external irradiation	Death, 1 mo. after treatment	Involvement by carcinoma of ear, mastoid, dura, labyrinth and temporal lobe; temporal lobe abscess (chronic); meningitis
2. D. I. 65 M	Adenocarcinoma	(No otorrhea) Facial paralysis: 2 yr. Pain (transitory): 1 yr. Headache: 3 mo. Zygomatic swelling: 3 wk. Deafness, total: long time Destruction of jaw joint, discernible in roentgenogram: duration unknown	(No operation) intensive external irradiation (patient did not return for complete treatment)	Death, 4 mo. later	No autopsy obtained (death in a city hospital)
3. S. F. 60 M	Fibrosarcoma	(No otorrhea) Facial paralysis (transitory) Pain: 3 wk. Deafness (partial): few yr. "Ear trouble": 9 yr.	(No operation); intensive external irradiation	Complete relief of symptoms over 3 yr. after admission; no ear discharge; no pain or headache; facial paralysis cleared up; gained in weight; hearing improved	
4. P. B. 56 M	Neurofibroma	(No otorrhea on admission) Facial paralysis: 3 wk. (No pain) Deafness, partial: at least 7 yr.	Radical mastoidectomy and irradiation therapy	No change in facial paralysis	

causing an abscess of the temporal lobe, indicating the futility of any form of treatment at this stage of the disease.

Extension of carcinoma through the bony wall of the vestibule was observed by Manasse.[19] Widespread sequestration of the labyrinth due

18. Moos, S.: Krebs des häutig-knorpeligen Gehörganges mit Durchbrechung der Muschel, Ausbreitung auf die untere Region des Wartzenforsatzes und Lähmung des N. facialis, Ztschr. f. Ohrenh. **13**:166, 1884.

19. Manasse, P.: Ueber primären Mittelohrkrebs mit sekundärer Labyrinthveränderungen, Arch. f. Ohrenh. **45**:122, 1898.

to carcinomatous invasion was demonstrated by Mathewson,[20] Nager,[21] Politzer,[22] Leidler [23] and others. The paramount importance of making the correct diagnosis early, in order that effective treatment may be instituted promptly, is obvious.

It has been remarked by some observers, namely, Schwartze,[1] Roosa,[24] Voislawsky,[16] Newhart,[15] Keeler [25] and many others, that chronic suppuration with its attendant constant irritation of the middle ear is the significant factor in the development of carcinoma of the middle ear. This hypothesis has been advanced as a cause of carcinoma in other parts of the body. Speaking of the cause, Newhart said that the purulent discharge of chronic otitis media is present in over 85 per cent of all cases. He expressed the belief that continued purulent discharge produces a chemical irritation to the epithelium of the middle ear, which results in the development of carcinoma. On the other hand, there are cases of carcinoma of the middle ear, reported by Billroth,[26] Schlittler [27] and Toynbee,[2] in which there never was a history of any discharge from the middle ear. Toynbee said he believed that in the 5 cases he reported, neoplasms probably arose in the mucous membrane of the tympanic cavity. Moos stated that carcinoma arises in the submucosa of the tympanic cavity. Marx [28] reported an unusual case in which he demonstrated a carcinoma developing in a cholesteatomatous membrane. More generally it can be stated that carcinomas involving the middle ear are associated, as Newhart, Keeler and many others previously have said, with fetid aural discharge, frequently blood stained.

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20. Mathewson, A.: A Case of Chronic Suppurative Inflammation of Middle Ear with Epithelial Tumor Extending Upward into the Cranial Cavity, Also with Extensive Necrosis of Mastoid and Other Portion of Temporal Bone, Tr. Am. Otol. Soc. **2**:270-273, 1875-1881.

21. Nager, F. R.: Ueber die Bildung von Labyrinthsequester bei Mittelohr-Karzinom, Verhandl. d. deutsch. otol. Gesellsch., 1908, pp. 130-135.

22. Politzer, A.: Krankengeschichte und Sectionsbefund eines an Karzinom Aur. Med. et Labyrinth. dext. verstorbenen 47 jährigen Mannes, Tr. Internat. M. Cong., 1881, pp. 406-408.

23. Leidler, R.: Die Mittelohrkarzinom im Lichte moderne Krebsforschung, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **77**:177-188, 1908.

24. Roosa, D. B. St. J.: Granuloma of the Tympanum, Post-Graduate **19**: 1028-1030, 1904.

25. Keeler, J. C.: Some Remarks on Otitic Malignancy: Report of Two Cases, Tr. Am. Laryng., Rhin. & Otol. Soc., 1922, pp. 25-34.

26. Billroth, T.: Epithelialkrebs des inneren Ohres, Arch. f. klin. Chir. **10**:67, 1869.

27. Schlittler, E.: Ueber das metastatischen Karzinom des Gehörorgans und über dessen Beziehung zur Meningitis carzinomatosa, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **103**:121-161, 1919.

28. Marx, H.: Carcinom und Cholesteatom des Ohres, Ztschr. f. Ohrenh. **46**: 209, 1904.

This is not always applicable to the other types of malignant growth which involve the middle ear.

It was pointed out by Thorell,[9] especially in regard to squamous cell carcinomas, which are most frequently associated with antecedent suppuration of the middle ear of varying duration, that the tumor extends considerably before the true nature of the process being dealt with becomes apparent. Technical advances in radiation therapy have made it possible to give patients with squamous cell carcinoma doses of 70,000 to 100,000 milligram hours over two to three weeks with relative safety. At Radiumhemmet (Stockholm, Sweden), of the 5 patients with squamous cell carcinoma treated radiologically, 2 remained well, 1 for nine years and the other for seven years. One patient had a recurrence after an incomplete mastoidectomy. This patient received irradiation exclusively after that and remained well for nine years, which indicates, as many therapeutists have repeatedly stated, that it is possible to obtain lasting cure by means of irradiation alone. As a result of the extensive experiences with squamous cell carcinoma of the middle ear and the nasal accessory sinuses at Radiumhemmet, it is felt there that the combined electrosurgical and irradiation therapy offers the best prognosis.

Case 2.—D. I., a man aged 65 years, was admitted to the service of Dr. Friesner complaining of progressive deafness, tinnitus and occasional stabbing pain in the left ear for one year. For the past three months he had had left-sided headaches which became noticeable first as an extreme sensitivity to cold, then as pin and needle sensations and finally as a feeling of great heat. The pain was aggravated by lying down, so that the patient would sleep propped up. At another institution seven weeks before admission, because of pain in the teeth, all his teeth were extracted. About three weeks before admission a zygomatic swelling on the left side appeared. Two years ago, according to the patient, there developed a paralysis of the facial nerve which "cleared up" in a few weeks after the use of "lamp therapy."

Examination of the right ear revealed no pathologic condition. In the left external auditory canal there was a large firm tumor mass which occluded the auditory canal, making it impossible to see the middle ear or the origin of the occluding mass. There were no vestibular responses to stimulation of the horizontal and vertical canals on the left side. The caloric responses on the right side were normal. There was complete deafness on the left side. The reaction to the fistula test was negative. The nasopharynx and the fundi oculi were normal.

Mastoid roentgenograms revealed diffuse haziness of the entire left mastoid and periantral region. The left petrous apex also appeared cloudy. Roentgenograms taken with the patient in the Stenvers position yielded no additional information. A roentgenogram of the nasal accessory sinuses showed a slight cloudiness of the right antrum. The left temporomandibular joint revealed destruction of the temporal bone anterior to the external auditory meatus and of that portion of bone forming the temporomandibular joint, a picture suggestive of a neoplastic process (fig. 3).

A biopsy was made of a specimen taken from the mass in the auditory canal, and the lesion was reported to be adenocarcinoma (fig. 4). After careful search

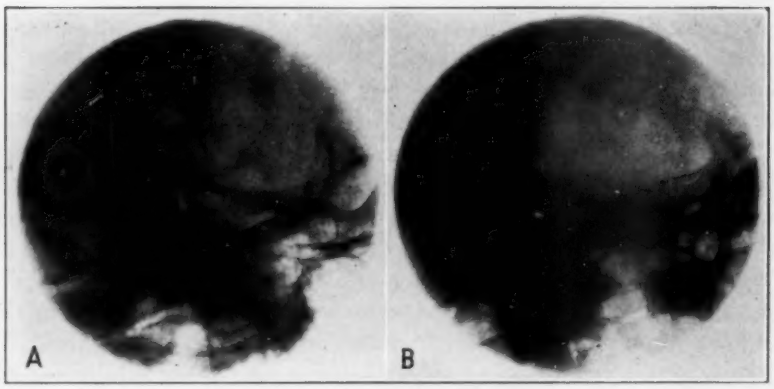

Fig. 3.—*A*, large defect involving the jaw joint and the zygoma (left side). *B*, normal condition on the uninvolved (right side) in the same patient.

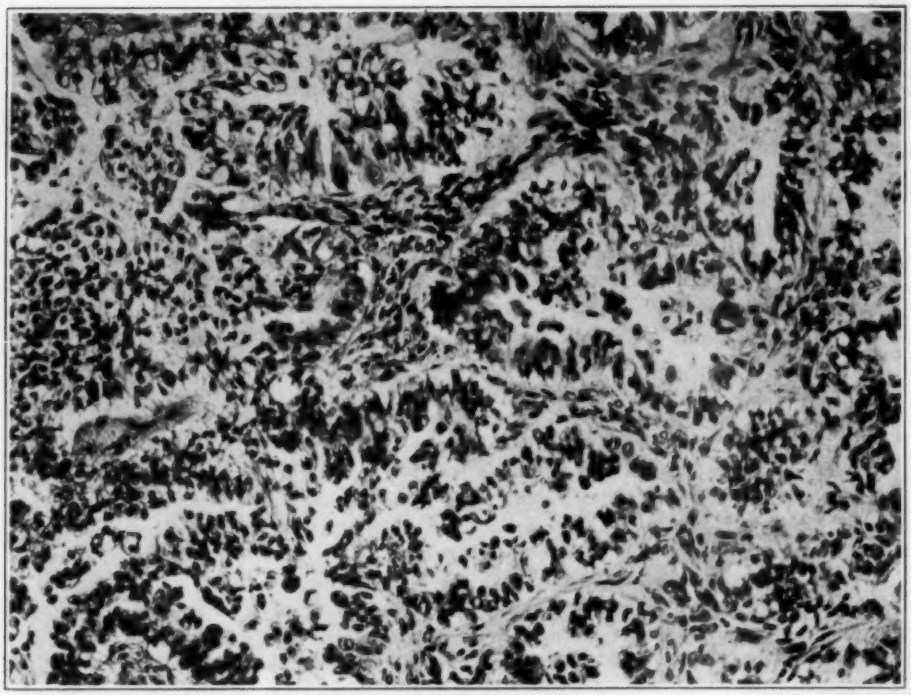

Fig. 4.—Section showing extensive adenocarcinoma.

failed to reveal a primary focus in the bones, sinuses, nasopharynx, prostate or gastrointestinal tract, the patient was referred to Dr. William Harris for the latter's opinion as to the type and amount of irradiation indicated.

Course.—As soon as irradiation was begun the pain in the ear was relieved. The patient was uncooperative about keeping his appointments and soon was lost sight of by the follow-up clinic. It was learned subsequently that the patient died at another hospital on Dec. 17, 1936, four months after he left the Mount Sinai hospital. A complete postmortem examination was not performed, and the possibility of a primary focus elsewhere in the body could not definitely be excluded.

Comment.—Of significance in this case were: (1) the transitory paralysis of the facial nerve, (2) the marked trigeminal symptoms, (3) the destruction of the temporomandibular joint and (4) the finding of adenocarcinoma at the biopsy. The history in this case is somewhat shorter than is usual, and there was no antecedent history of prolonged suppuration of the middle ear. Despite careful search, a primary focus could not be found. This type of tumor is not very amenable to radiation therapy, according to the experiences of the radiotherapeutist in this hospital. When this patient was first seen the process was advanced, as evidenced by the fact that the offending neoplasm already had invaded the temporomandibular joint and filled the fundus of the external auditory canal, making it impossible to determine the site from which the tumor arose. In regard to this stage of the disease, in the case I am presenting, I can speak only of the presence of an adenocarcinoma involving the middle ear and destroying the jaw joint anteriorly, and not of its origin. How far the process extended into the temporal bone was not precisely determined because exploratory operation was not performed.

In 1904, Lange [29] reported a cylindric cell carcinoma (adenocarcinoma) involving the middle ear, in a patient aged 83 years, who had long-standing otorrhea, pain, aural polypi and paralysis of the facial nerve. In 1924, Furstenberg [30] reported a primary adenocarcinoma involving the middle ear and mastoid. After a careful study of the literature he concluded that the most prominent symptom of cancer of the middle ear is pain. He also stated, as did Newhart, that invasion of the temporomandibular joint is not an uncommon symptom. Furstenberg's patient was alive and had been well for four and a half years at the time of the publication of his paper. Furstenberg performed radical excision of the tumor in association with postoperative roentgen therapy. The tumor was regarded as a primary adenocarcinoma of the middle ear, in the absence of all evidence of a primary tumor elsewhere. Furstenberg said it was his impression "that the growth therefore represented

29. Lange, W.: Ein Fall von primärem Zylinderzellenkarzinom des Mittelohres, Ztschr. f. Ohrenh. **46**:209-230, 1904.

30. Furstenberg, A. C.: Primary Adenocarcinoma of Middle Ear and Mastoid, Ann. Otol., Rhin. & Laryng. **33**:677-689, 1924.

a teratoid disturbance of development with blastomatous transformation." Additional cases of adenocarcinoma involving the middle ear have been reported by Heschelin [31] in 1925, Malan [32] in 1926 and Gritti [33] in 1934.

Malan's case was somewhat similar to case 2 of the present series, in that the condition occurred without any history of previous suppuration of the middle ear. According to Gritti, this is unusual. While it is true that in most cases of squamous cell carcinoma, of which there are many, there usually is a history of chronic suppuration of the middle ear, I believe there are too few instances of adenocarcinoma of the middle ear reported to permit one to conclude with any assurance just what role, if any, suppuration of the middle ear plays. The patients of Lange, Furstenberg, Heschelin and Gritti had histories of prolonged suppuration of the middle ear. In Malan's and in my case the conditions were not associated with otorrhea. According to Heschelin, adenocarcinomas have been reported by Manasse, Jurki and Treitel. Treitel stated that there is considerable difficulty in determining with accuracy whether the tumor arises from the skin of the external auditory canal and extends into the tympanum or whether it arises primarily in the middle ear.

When one encounters, as in the case just reported, a tumor filling the depths of the external auditory canal, associated with severe pain, roentgenographic evidences of a neoplastic process involving the middle ear and the joint of the jaw and finally a positive biopsy report of adenocarcinoma, the clinical picture is complete. If one grants, to simplify matters, that there is no primary focus anywhere else in the body, then one must consider either (1) that the tumor developed in the middle ear as a primary metaplastic growth or, as Furstenberg said, a teratoid disturbance of development with blastomatous transformation or (2) that it developed from the external auditory canal and secondarily invaded the tympanic cavity and adjacent structures. One must also admit that either explanation might be true in a specific instance, and when the condition is first observed in an advanced stage of the disease, as in this instance, an opinion of the pathogenesis is pure conjecture.

In the light of the reports in the literature and of my experience with this case, I should now treat a patient with adenocarcinoma involving the middle ear, with preliminary preoperative irradiation, then widely explore according to the technic described by Thorell,[9] Furstenberg,[30] Schall [12] and others, and finally employ intensive postoperative irradiation. It is evident from the literature, with the notable exception

31. Heschelin, A.: Primärer Krebs des Mittelohres, Acta oto-laryng. **7**:412-418, 1924-1925.

32. Malan, A.: Adenocarcinoma dell'orecchio medio, Valsalva **2**:15-19, 1926.

33. Gritti, P.: Adenocarcinoma dell'orecchio medio, Oto-rino-laring. ital. **4**: 503-515, 1934.

of Furstenberg's case, that one has little to lose in persisting in a most radical approach when dealing with as malignant and advanced a process as the one occurring in the case just reported.

Case 3.—S. F., a man aged 60, was referred to the otologic service of Dr. I. Friesner complaining of pain in the right ear for three weeks. Nine years previously the patient had pain in the right ear which persisted for three months. The drum was incised at that time, but there was no discharge. Shortly thereafter a complete peripheral paralysis of the facial nerve appeared, and after some months partial resolution occurred. Five months before admission to the Mount Sinai

Fig. 5.—Section showing a fibromatous tumor with marked cellularity and with occasional mitotic figures. The diagnosis was fibrosarcoma.

Hospital, the pain in the right ear recurred. There was no aural discharge, and the partial paralysis of the facial nerve did not change. This episode of pain subsided. Three weeks before admission the pain in the right ear recurred once more and persisted. At this time, however, the paralysis of the facial nerve became worse.

Examination revealed a moderately sick patient with generalized arteriosclerosis and hypertension. The left ear drum was retracted, and all of the landmarks were present. On the right side was a large, hard mass which appeared adherent to the posterior canal wall. Anteriorly a rim of drum could be seen, and this portion appeared somewhat full. No landmarks could be seen. The hearing was impaired. There was no involvement of cranial nerves other than the peripheral paralysis of the facial nerve.

A biopsy was made of tissue taken from the hard mass adherent to the posterior canal wall obscuring the drum, and the lesion was reported to be "cellular fibroma with slight cell atypism and sporadic mitosis." Because this examination was not satisfactory, a second biopsy was performed, which revealed "a fibromatous tumor which, however, in one area showed marked cellularity with occasional mitosis, highly suspicious of fibrosarcoma" (fig. 5).

Treatment and Course.—Because of the history of recurring paralysis of the facial nerve, the pain, the physical findings and the pathologic reports, the radiotherapeutist, Dr. William Harris, advised high voltage roentgen treatment applied to the right middle ear and mastoid region.

Follow-Up: The patient was seen on Jan. 4, 1936, four months after his discharge from the hospital, at which time radiotherapy was completed. He was seen again in November 1936, when he was feeling better and had less pain. The paralysis of the facial nerve was unchanged. In April 1939 the paralysis of the facial nerve was almost entirely gone, the drum was intact, the landmarks were present, the hearing was good and the general condition appeared excellent. In October 1939 the patient was well, and the middle ear and external canal were normal. In December 1939 the patient was still well, and there was no involvement of the seventh or the eighth nerve.

Comment.—The recurring attacks of paralysis of the facial nerve over a long period should make one suspect a neoplasm. Of further diagnostic significance is the prolonged history of pain in the ear, in the absence of aural infection. The discovery of a firm tumor deep in the external auditory canal, associated with prolonged pain, evanescent paralysis of the facial nerve, with or without discharge from the middle ear, should always spell biopsy to rule out the possibility of a malignant growth. The patient in this case was not operated on. He has been followed carefully for almost four years, and to my mind his condition represents an excellent result obtained entirely by irradiation therapy. According to Hesse [34] it is not always advisable to undertake dangerous and deforming operations to achieve wide removal of a sarcoma, as one would attempt in the case of carcinoma, as sarcomas are much more radiosensitive; the result obtained in this case, though only a single case, is most gratifying. The prognosis in sarcoma involving the middle ear is much worse in young children than in adults, according to Keeler.[25]

Case 4.—P. B., a porter, was referred to the service of Dr. J. Maybaum complaining of paralysis of the facial nerve on the right side of three weeks' duration. For seven years he had been conscious of increasing deafness in the right ear. There was no associated pain, headache, vertigo, vomiting or diplopia. The depths of the external auditory canal of the right ear were filled by a large firm mass, which was painless and which bled rather freely when touched. No landmarks were evident, and it was determined with the use of the Bárány noise apparatus that the patient had hearing in the right ear. In addition the patient

34. Hesse: Zur Behandlung maligner Tumoren des Hals- Nasen- und Ohrengebietes, Ztschr. f. Hals-, Nasen- u. Ohrenh. **31**:233-247, 1932.

presented the picture of chronic alcoholism together with avitaminosis and generalized arteriosclerosis. Examination of the nasopharynx for neoplasm and inflammation revealed no abnormalities.

A roentgenogram of the mastoid revealed sclerosis but no evidence of neoplasm. The temporomandibular joints failed to show any abnormalities. The reactions of the blood to the Wassermann and the Kahn test were both negative. The report of biopsy of tissue from the mass filling the external auditory canal and tympanum was given by Dr. Klemperer as "fragment of cellular fibroma, possibly neurofibroma with severe inflammation." The patient was discharged to the follow-up clinic of the outpatient department, and after the evidence of acute

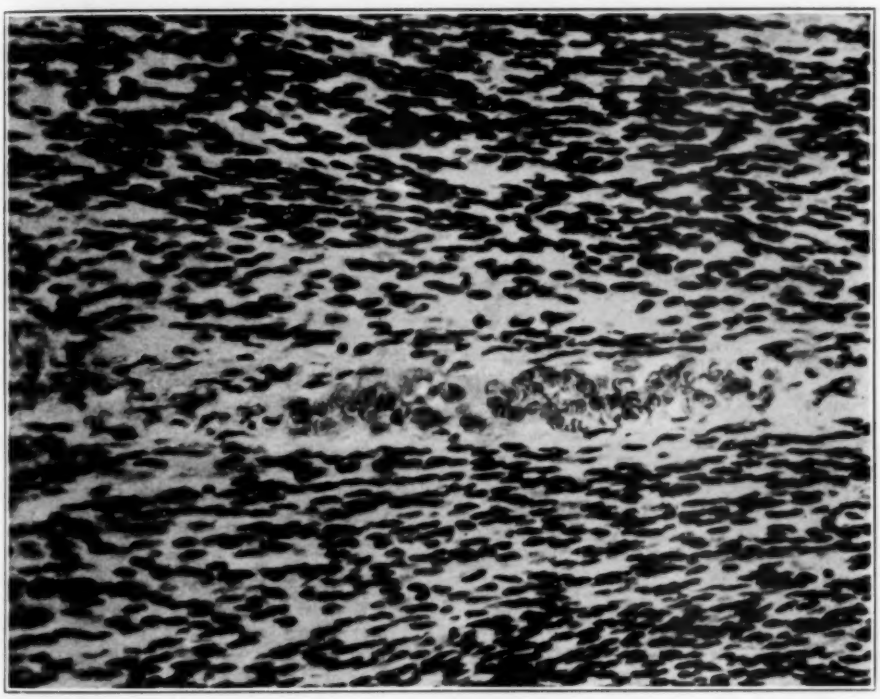

Fig. 6.—Section showing cellular fibromatous tissue, the arrangement of which is strongly suggestive of neurofibroma.

inflammation had subsided he was readmitted, for exploratory operation. Radical mastoidectomy was performed. There was erosion of the external semicircular canal. Yellowish-looking tissue from the middle ear and mastoid antrum was removed. Overlying the stapes and apparently arising from the posterior canal wall (fallopian canal), this neoplastic tissue in all probability accounted for the paralysis of the facial nerve. Culture of the secretion from the mastoid did not yield any growth. Histologic sections of this tissue were studied by Dr. Klemperer, and the report was "cellular fibroma, possibly neurofibroma" (fig. 6).

Postoperative Course.—There was no change in the paralysis of the facial nerve nor any evidence of intracranial extension of the neurofibroma. The neurologist observed a small lipoma on the arm and in considering the pathologic report sug-

gested the possibility of Recklinghausen's disease. Tarsorrhaphy was performed by the ophthalmologists in an attempt to prevent corneal ulceration. After a month the patient was discharged relatively unimproved to the otologic follow-up clinic for necessary dressings. He was referred also to Dr. William Harris, the radiotherapeutist, for treatment, although it was realized full well that neurofibromas are very resistant to even the most intensive irradiation.

Follow-Up: In October 1939 the patient was living. He was working as a night watchman and seemed to be symptom free as far as his ear was concerned except that the paralysis of the facial nerve was still present.

Comment.—Williams and Pastore [35] recently (1939) reported a case of neurofibroma of the facial nerve in the facial canal, which caused destruction of the labyrinth and the mastoid process, mentioning that the case apparently was the first of its kind to be reported in the literature. In case 4 of the present series the neurofibroma, yellowish and firm, apparently originated from the posterior bony canal in the region of the facial canal and did not involve the labyrinth or the mastoid. The lesion seemed more or less confined to the middle ear. It is not improbable that had this patient been permitted to go on without being operated on erosion of the mastoid bone and the labyrinth capsule might have eventuated. Neurofibromas are slowly growing tumors which do not metastasize or involve neighboring lymph nodes. The histologic sections established the diagnosis.

I am in complete accord with the attitude of Williams and Pastore,[35] who declared:

> . . . when the results of biopsy [of tissue from the aural canal] are inconclusive, we feel that operation on the mastoid process is indicated, to make a differential diagnosis and to remove a nonmalignant lesion if it is present or to attempt excision of a malignant lesion if it seems operable.

In their case, acting in accordance with this attitude resulted in the discovery of a neurofibroma. Postoperatively Williams and Pastore treated their patient with radiotherapy also, in spite of the known fact that these tumors are radioresistant.

A perineural fibroma involving the greater superficial petrosal nerve, in the region of the geniculate ganglion, was reported in 1936 by Tremble and Penfield.[36] The middle ears were normal in their patient, and paralysis of the facial nerve was the presenting symptom. Neurofibromas involving the eighth nerve and some other portions of the body are not uncommon, but neurofibromas involving the facial nerve, as in the fourth case of this series and in that of Williams and Pastore, are rare.

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35. Williams, H. L., and Pastore, P. N.: Neurofibroma of Facial Nerve in the Facial Canal: Destruction of Labyrinth and Mastoid Process, Arch. Otolaryng. **29**:977-981 (June) 1939.

36. Tremble, G. E., and Penfield, W.: Operative Exposure of Facial Canal with Removal of a Tumor of the Greater Superficial Petrosal Nerve, Arch. Otolaryng. **23**:573-579 (May) 1936.

On the patient whose case was just reported, operation was first performed on May 1, 1937, and since then he has been able to work. The paralysis of the facial nerve is still present, and there is no evidence of extension of the neoplasm centrally, a not unusual feature in so slowly developing a tumor as neurofibroma. Contact with the patient is being maintained in the follow-up clinic because of the known tendency for neuromas and neurofibromas occasionally to undergo sarcomatous degeneration.

SUMMARY AND CONCLUSION

Four cases, namely of (1) squamous cell carcinoma, (2) adenocarcinoma, (3) fibrosarcoma and (4) neurofibroma involving the middle ear, are presented.

The futility of any form of treatment of advanced malignant growths is demonstrated by case 1, in which the tumor, a squamous cell carcinoma, had already extended into the substance of the temporal lobe, and by case 2, in which the tumor, an adenocarcinoma, had extensively invaded the temporomandibular joint and the zygoma.

As a general rule, one ought to regard as potentially malignant all growths situated deep in the external auditory canal, regardless of whether they are associated with bloody discharge, pain or paralysis of the facial nerve. Results of one biopsy if negative do not negate the possibility of a malignant growth. In a patient with known chronic suppuration of the middle ear associated with polypi, a superimposed malignant growth may develop at any period of the infection. The onset of pain, paralysis of the facial nerve, or bloody discharge in chronic suppuration of the middle ear should make one suspect neoplasm. At present, it is the consensus that the treatment by radical electrosurgical removal combined with intensive external irradiation is the method of choice in the therapy of neoplasms involving the middle ear.

INTRADURAL CONDITIONS IN RELATION TO RHINOLOGY AND OTOLOGY

CRITICAL SURVEY OF RECENT LITERATURE

WELLS P. EAGLETON, M.D.
NEWARK, N. J.

POLIOMYELITIS

Schultz and Gebhardt,[1] in 1931, demonstrated that the virus of poliomyelitis passes from the mucous membranes by way of the olfactory nerve, olfactory bulb and olfactory tracts.

ENTRANCE AND PATHWAYS OF THE VIRUS

In 1938, Schultz [2] reviewed the whole subject of anatomy of the olfactory apparatus. In man the olfactory portion of the nasal mucous membrane occupies the upper third of the nasal septum, nearly the whole of the superior concha and a small portion of the middle concha (Schaeffer [3]). This area is differentiated from the adjacent mucosa by its yellowish or brownish tint and its slightly greater thickness.

Histologically, three kinds of cells may be recognized in the olfactory area: (1) true olfactory nerve cells, (2) supporting, or sustentacular, cells and (3) small stellate basal cells. The cells rest directly on the tunica propria, without an intervening basement membrane, this being the only area in the body where nerve cells are exposed to direct infection from the exterior.

The olfactory nerve cells lie between the deep processes of the supporting, or sustentacular, cells. Each branch of the nerve receives its sheath from the dura and the pia-arachnoid.

A mimeographed index of all the articles surveyed by me for the Archives during the years of 1925 and 1939 is being prepared. A copy will be sent to any physician or library on personal application to Wells P. Eagleton, 15 Lombardy St., Newark, N. J.

1. Schultz, E. W., and Gebhardt, L. P.: Olfactory Tract and Poliomyelitis, Proc. Soc. Exper. Biol. & Med. **31**:728-730 (March) 1934.

2. Schultz, E. W.: Future of Chemoprophylaxis as a Measure for the Practical Control of Poliomyelitis, J. Pediat. **13**:38-59 (July) 1938.

3. Schaeffer, J. P.: The Nose, Paranasal Sinuses, Nasolacrimal Passage-Ways, and Olfactory Organ, Philadelphia, P. Blakiston's Son & Co., 1920, p. 370; The Mucous Membrane of the Nasal Cavity and the Paranasal Sinuses, in Cowdry, E. V.: Special Cytology, New York, Paul B. Hoeber, 1928, vol. 1, p. 47.

It was these spaces that Flexner earlier thought to be the route by which the virus of poliomyelitis might pass to the central nervous system. But, while there is evidence that bacteria [4] and certain neurotropic viruses, such as that of equine encephalomyelitis (Rake [5]), may take this route, it now seems that these perineural spaces can be excluded as the important route taken by the virus of poliomyelitis, because of the evidence pointing to the olfactory neurons themselves.

Pathogenesis of Virus Disease in General

The fact is now recognized that viruses in general are dependent on specific tissue cells, the virus process being often so specialized that only certain cells may be attacked. For multiplication of a virus there must be very intimate association with the particular cells suited to its propagation. That an actual invasion of the cells exists is evidenced by the distinctive pathologic character of virus diseases and by the exacting requirements for the successful cultivation of viruses outside the body; no filter-passing virus has yet been propagated outside the body in the absence of living tissue cells. However, many viruses have been cultivated in cultures of embryonic tissues and in the chorioallantoic membrane of the developing chick.

Pathogenesis of Poliomyelitis

Sabin and Olitsky [6] demonstrated that the virus of poliomyelitis can be cultivated in various kinds of mediums only in the presence of neural tissue from the human embryo, which testifies to the high selectivity of this virus.

Faber [7] concluded (1) that poliomyelitis is primarily an infection of the central nervous system throughout its entire course; (2) that the virus is transmitted *axonally*, being in intimate association with the neurons from the portal of entry onward, and (3) that degeneration of susceptible nerve cells does not occur until a certain rather high concentration of virus has been reached.

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4. Clark, W. E. G.: Report to the Committee on Vaccination on an Anatomical Investigation into the Routes by Which Infections May Pass from the Nasal Cavities into the Brain, Ministry of Health, Reports on Public Health Subjects, no. 54, London, His Majesty's Stationery Office, 1929.

5. Rake, G.: Rapid Invasion of Body Through Olfactory Mucosa, J. Exper. Med. **65**:303-315 (Feb.) 1937.

6. Sabin, A. B., and Olitsky, P. K.: Cultivation of Poliomyelitis Virus in Vitro in Human Embryonic Nervous Tissue, Proc. Soc. Exper. Biol. & Med. **34**:357-359 (April) 1936.

7. Faber, H. K.: Acute Poliomyelitis as Primary Disease of Central Nervous System, Medicine **12**:83-186 (May) 1933.

Observations by Schultz [2] lend additional support to the view that the transmission of this virus, which measures only about 10 millimicrons and is among the smallest of the known viruses, is primarily axonal. He also showed that the virus may be present in fairly high concentrations before any paralysis makes its appearance. The motor cells in the lumbar portion of the cord are more susceptible to the virus than are those in the cervical portion.

Once the virus has reached the central nervous system, its propagation is definitely associated with neurons. The accessibility of neurons to a highly neurotropic virus explains satisfactorily why section of the olfactory tracts prevents the passage of the virus to the central nervous system, for not only are the hairlike endings exposed at the surface of the olfactory mucosa but the bulbous enlargements bearing these hairs are exposed also. And it explains, moreover, why the olfactory perineural spaces and the spinal fluid need not play important roles in carrying the virus to the central nervous system.

Arguments Against Olfactory Route of Infection.—Landon and Smith's observations (1934) on some 56 olfactory bulbs from human beings who died of this disease are arguments against the theory that the olfactory nerve in man is the common pathway for the virus. Little pathologic change was seen in most of the bulbs, although edema and congestion were rather frequently observed; fewer than one fourth showed cellular infiltrations.

Again, Harmon and Levine (1938) reported that only 2 of 9 patients who died of poliomyelitis had lesions in the olfactory bulbs.

Other Routes of Infection.—(*a*) Digestive Tract: A few investigators believe that in man the olfactory nerve is probably not a frequent portal of entry. Kling and his associates,[8] of Sweden, have stated that the digestive tract may be the most important portal. However, the work of Kling, Levaditi and Hornus [9] shows that it is easier to infect monkeys by the intranasal route than by the alimentary route.

(*b*) Skin: It would seem that for the occurrence of infection through the skin one must presuppose an abrasion or injury sufficient to allow a skin-containing virus to come in contact with the cutaneous nerves.

(*c*) Oral and Nasal Washings: It is difficult to prove the presence of virus in oral and nasal washings, although it has been demonstrated

8. Kling, C.; Levaditi, C., and Lépine, P.: La pénétration de virus poliomyélitique à travers la muqueuse du tube digestif chez le singe et sa conservation dans l'eau, Bull. Acad. de méd., Paris **102**:158-165 (Oct. 8) 1929.

9. Kling, C.; Levaditi, C., and Hornus, G.: Comparaison entre les divers modes de contamination du singe par le virus poliomyélitique (voies digestive et nasopharyngée), Bull. Acad. de méd., Paris **111**:709-716 (May 29) 1934.

in such washings from patients, from human convalescents and from infected monkeys. Its low concentration in the nasal washings may mean that higher and more easily demonstrable concentrations are to be found in tissues and organs which lie below the olfactory area and in a position to receive virus from above.

(*d*) Tonsils: Virus has been recovered from the tonsils and adenoids of convalescents and exposed persons. Kramer [10] recovered virus from the tonsils and adenoids of a child who had had no known contact with the disease.

CHEMICOPROPHYLAXIS

Schultz granted that the application of chemical solutions may be proved worthless in preventing the disease in man. Observations with the trinitrophenol-alum spray in Alabama in 1936 were inconclusive. Recently zinc sulfate solution was used in Toronto, Canada, but this experiment also failed to yield information on this point.

It is Schultz's opinion that the possibilities of chemical prophylaxis should be explored further, for at present such a measure seems to offer the only promise of a practical solution. A satisfactory field test is needed to determine whether this type of prophylaxis, so effective in monkeys, is applicable to man.

Technic of Application of Zinc Sulfate

Zinc sulfate solutions cannot be applied to the olfactory area with an ordinary atomizer. Pentecost (1937) devised a technic for the introduction of zinc sulfate. The head is placed in the Proetz position ("head inverted so that the chin and external auditory meatuses are in the same vertical plane"), the position commonly used in filling the sphenoid sinuses with solution.

Technic of Prophylaxis by Chemical Agents

That a chemical agent (such as 1 per cent zinc sulfate) confers on monkeys a high degree of resistance to poliomyelitis virus for at least one month after treatment suggests that use of such a prophylactic substance deserves a trial in human beings during periods when poliomyelitis is prevalent.

Shahinian, Bacher, McNaught and Newell [11] presented roentgen and clinical evidence of the following facts: 1. Limited quantities of fluid

10. Kramer, S. D.: Detection of Healthy Carrier of Virus of Poliomyelitis Without History of Contact, Proc. Soc. Exper. Biol. & Med. **32**:1165-1172 (April) 1935.

11. Shahinian, L.; Bacher, F. A.; McNaught, R. C., and Newell, R. R.: Chemoprophylaxis in Poliomyelitis: Technic of Applying Chemical Agents to the Olfactory Mucosa, J. A. M. A. **110**:1254-1257 (April 16) 1938.

introduced slowly into the olfactory sulcus will flow along the groove and fill the inverted common nasal meatus to a height sufficient to immerse most of the estimated olfactory area when the head is completely inverted, with the base line horizontal. 2. Previous shrinkage of the nose is necessary. 3. Solutions are better tolerated in the nose when previously warmed to body temperature.

Method.—Ordinary medicine droppers, previously calibrated for volume, are inserted 0.5 cm. into the naris, without touching the sensitive mucous membrane of the walls.

The fluid is introduced slowly and steadily, drop by drop. The patient is kept in the inverted position for one minute after the last drop has entered. The solution may be emptied by having the patient turn over into the prone position, lift his head and sniff outward. The procedure prevents unpleasant effects on the throat due to the patient's swallowing the solution. The approximate quantity of fluid necessary to immerse the olfactory membrane adequately by this method is 0.5 cc. for children less than 10 years of age, 0.4 cc. for children between 10 and 14 years of age and 0.25 cc. for adults. A portion of the fluid will overflow in some instances.

SERUM TREATMENT OF POLIOMYELITIS

It was Rosenow's [12] purpose to review the more important results obtained in investigation of the relation of the streptococcus to poliomyelitis and to show how his studies have culminated in a simple diagnostic cutaneous test and an effective treatment of poliomyelitis with poliomyelitis antistreptococcus serum. The streptococcus, first isolated in 1916 from the nasopharynx, brain and spinal cord and demonstrated in the lesions, has since been consistently isolated from the nasopharynges, brains and spinal cords of persons who succumbed to poliomyelitis in each of fourteen epidemics studied and from the brains and spinal cords (virus) of 511 monkeys that succumbed to inoculations with 128 different strains of poliomyelitis virus.

Cultures in dextrose–brain broth yielded the streptococcus in 180, or 80 per cent, of 224 instances in which monkeys that subsequently had paralysis died or were anesthetized within ten days after inoculation with filtered or emulsified virus. In another series the streptococcus was isolated from the spinal cords of 162, or 89 per cent, of 181 monkeys with poliomyelitis. About 33 per cent of numerous filtrates of the virus yielded the streptococcus, almost always in pure culture.

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12. Rosenow, E. C.: The Early Diagnosis and Treatment of Poliomyelitis with Poliomyelitis Antistreptococcic Serum, Illinois M. J. **76**:144-148 (Aug.) 1939.

The streptococcus was consistently demonstrated by microscopic examination of the sediment of the spinal fluid and by cultures in dextrose–brain broth in the early stages of the disease in human beings and in monkeys.

The streptococci isolated from the brain and spinal cord in instances of the spontaneous disease among human beings and in instances of the experimental (virus) disease among monkeys were, culturally and morphologically, identical or similar in virulence and in immunologic characteristics. They produced flaccid paralysis in guinea pigs, rabbits and monkeys. They had identical "neurotropic" distribution curves of cataphoretic velocity. During the acute stage of the disease the serums of human beings and monkeys were shown to contain streptococcus antigen, and during convalescence they contained specific antibodies alike for the virus and for the streptococcus. Intradermal injections of suitable suspensions of the heat-killed streptococcus proved to be a test of susceptibility to poliomyelitis. Several subcutaneous vaccinations of reactors (susceptible persons) with heat-killed streptococci caused the reactivity of the skin to disappear (immunity).

By the use of a medium a transmissible filtrable virus has been produced from streptococci.

Diagnostic Cutaneous Test for Poliomyelitis

An erythematous reaction together with suggestive symptoms indicates that therapeutic injections of the serum should be given at once. This test is an application to streptococcic diseases of the Foshay antibody-antigen reaction, first noted in cases of tularemia. Through use of the euglobulin, or bacterial antibody fraction, of the antistreptococcus serum the test serves to determine whether a given patient is suffering from a streptococcic infection and, if so, what particular type of infection is present and what antiserum or stock vaccine can best be employed therapeutically.

The highest incidence of reactions and the maximal average reaction to the poliomyelitis euglobulin occurred during the acute stage of epidemic poliomyelitis.

Therapeutic injection once or twice daily of the 10 per cent solution of the euglobulin to which the cutaneous reaction is positive or of a mixture of the euglobulin and pseudoglobulin in like concentration in quantities of 5 cc. for children 5 years or less of age, with an additional 1 cc. at each injection for each additional year of age up to 20 years, for one or two days in the "prepoliomyelitis" stage and for two to four days in the "preparalytic" stage, caused the results of the cutaneous test to become negative and resulted in recovery without paralysis.

Protection of Monkeys Against Experimental Poliomyelitis

In Rosenow's studies, different batches of fresh streptococcus antiserum, used in the treatment of this disease in human beings throughout many years, were injected intravenously or intramuscularly into monkeys after intracerebral inoculation of highly virulent virus. Only 36, or 40 per cent, of 91 monkeys that received the serum intravenously or intramuscularly before and after onset of symptoms died from poliomyelitis. In contrast, 21, or 78 per cent, of 27 monkeys treated in like manner with normal horse serum died of poliomyelitis.

Treatment of Poliomyelitis in Human Beings with Poliomyelitic Antistreptococcus Serum

The patients treated represented victims of many different epidemics of poliomyelitis in widely separated localities. The mortality and incidence of residual paralysis, the two most important factors in this disease, were always lower in cases in which the serum was administered. If the serum was given in the early stages of the disease, the incidence of residual paralyses was much lower, often tenfold lower, than in the cases in which serum was not administered.

Lowered Mortality.—The earlier the serum treatment was begun, the more favorable were the results. The mortality in the 2,445 cases in which serum was administered was only 8 per cent, and the incidence of severe residual paralysis in 1,566 cases was 11 per cent. These figures are in contrast to a mortality of 21 per cent in 2,377 cases in which serum was not employed and to the incidence of severe residual paralysis in 36 per cent of 429 cases in which follow-up data were obtained.

Quick Relief of Symptoms.—Restless, nervous children often fell asleep soon after the first injection of serum. Headache and pain in the involved extremity or part were often lessened or relieved. The temperature curve usually dropped rapidly to normal after an initial rise. Progressing paralysis was often seemingly arrested.

Summary of Serum Treatment

Studies made by special methods indicate a causal relationship of the streptococcus to epidemic poliomyelitis. Poliomyelitis antistreptococcus serum affords a simple method for the early diagnosis of poliomyelitis.

STAGES OF POLIOMYELITIS

Felderman [13] divided the course of poliomyelitis into three stages: (1) a generalized infection with systemic involvement; (2) symptoms

13. Felderman, L.: Acute Anterior Poliomyelitis with Special Reference to Its Rhinological Aspect, Laryngoscope **48**:802-818 (Nov.) 1938.

which involve the central nervous system, particularly the meninges, and (3) impairment of the nervous center of the peripheral motor neurons.

The ages of the patients vary from 6 months to 12 years, with an average age of 4 years.

BIOCHEMISTRY OF THE OLFACTORY END-ORGANS

"The olfactory receptors . . . a series of specialized end-organs . . . are stimulated by aromatic and volatile substances, which act upon the specialized olfactory mucous membrane of the nose."

THE "ORGANISMAL UNIT CELL"

"Every change in the environment registers in the living cell . . . To maintain a biological balance, the human cell must display three characteristics: (*a*) irritability; (*b*) respiratory action for gaseous exchange; and (*c*) ability to synthesize." The chief factors in the determination of its special type of cell activity are both its chemical composition and its structural or morphologic constitution.

Basic protoplasmic structure resembles an emulsion which contains two or more fluid phases of different composition, "one (or more) of which is in a fine state of subdivision and suspended or otherwise dispersed in the other, which is continuous."

Felderman continued:

> Once the cell permeability is disturbed, the colloidal equilibrium is unbalanced, and if extensive, that particular tissue degrades . . . Cell permeability may be due to changes of temperature, difference of osmotic pressure, difference of H-ion concentration, presence of special chemical substances . . . Each cell organism has a special peculiarity of action and reaction, which depends upon the inherited organization of the cell structure.

PHYSIOLOGIC MECHANISM OF PREVENTION OF POLIOMYELITIS

"The key to prevention of poliomyelitis resides in the knowledge of the physiological behavior of the nasal ciliated epithelium." Any factor which interferes with ventilation and drainage of the accessory sinuses of the nose (such as swimming, diving or overheating of a house or apartment) will throw out of balance the harmonious relations of the ciliated epithelium ("hair brushes") and predispose the patient to infection, whether from a germ or a virus.

Solutions applied to the nasal mucosa should not alter the normal p_H and should maintain the function of the defensive ciliary processes. Felderman concluded that a chemotherapeutic agent that will not slow up the ciliary movement is the agent of choice in prevention of poliomyelitis.

DIASTASE IN CEREBROSPINAL FLUID IN POLIOMYELITIS

Eckardt [14] found that the inflammatory processes which develop in the central nervous systems of patients with poliomyelitis cause an increase in the diastase content of the cerebrospinal fluid (normally about 50 mg. per hundred cubic centimeters). The comparatively slight increase in cells together with a great increase in the diastase content proves that, independent of the number of cells, the diastase increases under the stimulus of inflammatory processes in the central nervous system.

Comment by Reviewer: In French usage diastase means any ferment. In English and American usage it is the substance that converts starch into dextrose. It is not clear what usage this author adopts.—W. P. E.

ANATOMY OF GUSTATORY AND OLFACTORY SYSTEMS IN RELATION TO REGIONAL PATHOLOGIC CONDITIONS

LOCALIZING VALUE OF TESTS FOR SITUATION OF TUMORS OF THE BRAIN

Olfactory Tests (Elsberg's Method) Compared with Ventriculography and Encephalography

Elsberg [15] compared the diagnostic findings obtained with the olfactory tests in 61 cases of verified tumor of the brain with those obtained by encephalography and ventriculography. In 77 per cent of his cases localization of the lesion in one or the other cerebral hemisphere was determined by his olfactory tests. And in 80 per cent of the cases in which the lesions were so localized the olfactory tests gave "adequate information" as to the region to be exposed at operation.

Localization by olfactory tests was more accurate for tumors of the frontal and temporal lobes than for parietal, occipital and parasagittal tumors.

In 28 of his 61 cases (46 per cent) the results of the olfactory tests agreed with those of ventriculography and encephalography in indicating the exact localization of the tumor. In 31 cases (51 per cent) the roentgen studies gave more accurate information; in the remaining 2 (3 per cent) the olfactory tests gave the more exact localization.

Ventriculography and encephalography showed the cerebral hemisphere involved in 98 per cent of all cases.

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14. Eckardt, F.: Ueber Diastase im Liquor cerebrospinalis bei Poliomyelitis, Jahrb. f. Kinderh. **142**:303-309 (May) 1934; abstracted, J. A. M. A. **103**:147 (July 14) 1934.

15. Elsberg, C. A.: Comparison of the Results of Encephalography and Ventriculography and of Quantitative Olfactory Tests for the Brain, Bull. Neurol. Inst. New York **6**:403-410 (Dec.) 1937.

OLFACTORY DISTURBANCE ASSOCIATED WITH HEAD INJURY

Olfactory disturbance may appear as a sequel of injury to the head. However, little attention has been paid to it, as the anosmia is in most cases without meaning to the patient and often is not noticed by him. Olfactory disturbances following trauma of the head are significant chiefly in that they may represent a local symptom of a lesion of the orbital lobe.

Personality Changes with Olfactory Disturbances

During the past few years, of 32 patients with contusion of the brain all showed personality changes due to the trauma; olfactory disturbance was discovered in 17 cases, in 9 of which it was the only neurologic symptom.[16] In 1 case the diagnosis of a traumatic lesion of the orbital region was not made until eight years after the accident, when olfactory investigation revealed that the sense of smell was lost in the left and deteriorated in the right nostril.

Technic of Examination for Olfactory Disturbances

Bay has used the following aromatic substances: rose water; bitter almond water; tincture of valerian; rectified oil of birch tar; oil of lavender; oil of turpentine; "strong camphorated oil"; oil of peppermint; coffee, and pyridine. Recognition of these substances depends on the olfactory nerves.

"Dr. Elsberg and his co-workers advise the use of coffee and citral for clinical olfactometry." Coffee is considered stimulating to the olfactory nerves alone, without any effect on the trigeminal nerves. Citral likewise, when used in the small volumes needed for the blast injection test, has no effect on the trigeminal nerves.

To insure that it was really the olfactory nerve that was damaged, Bay tested the perception of other substances which are not, or not entirely, determined by the olfactory nerve. These included chloroform, which has a sweet taste component, ammonium carbonate and anisated spirit of ammonia, both of which stimulate the trigeminal nerve.

ANOSMIA FROM INJURY TO OCCIPITAL REGION

Goland [17] applied olfactometry to 60 patients with acute trauma of the head. Three of 38 patients with uncomplicated injury to the occipital region of the skull showed complete anosmia.

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16. Bay, E.: Ueber die Bedeutung der Riechprüfung für die Beurteilung von Kommotionsfolgen, Nervenarzt **12**:142-148 (March) 1939; abstracted, Neuro-Psychiatric Institute of the Hartford Retreat, ser. 7, no. 179, Aug. 14, 1939.

17. Goland, P. D.: Olfactometry in Cases of Acute Head Injury, Arch. Surg. **35**:1173-1182 (Dec.) 1937.

Goland concluded that falls or blows on the back of the neck and the occiput seem to be predominant in producing disturbance or loss of the sense of smell. The occurrence of anosmia after such an injury is not infrequent.

Injuries of the anterior portions of the head (i. e., without local injury to the nose or fracture through the cribriform plate) seem to play a secondary role in producing disturbances of the sense of smell.

Cerebral Mechanism in the Production of Anosmia Following Head Injuries

Goland [17] discussed the mechanism of head injury as the possible cause of anosmia in the 3 cases that he reported.

Anatomic Connection Involved in the Sensation of Smell.—The olfactory nerve arises from a small area of nasal mucous membrane in the upper portion of the nasal septum and the adjacent upper portion of the superior nasal concha. Fine filaments of the olfactory nerve perforate the cribriform plate of the ethmoid bone and enter the corresponding olfactory bulb. The central olfactory tract is made up of the lateral and medial olfactory striae, which pass from the olfactory bulb to the cortical center for smell, which is located near the tip of the hippocampal gyrus of the temporosphenoid lobe.

Each olfactory bulb is connected with the hippocampal gyrus of its own side, by means of the lateral olfactory striae, and also with the hippocampal gyrus of the other side, by means of the median olfactory striae through the anterior commissure.

Goland suggested a mechanism of injury in which the lateral olfactory striae and the tips of the temporosphenoid lobes are injured against the lesser wings of the sphenoid bone, as the lateral olfactory striae are considered to contain a predominantly greater number of the secondary fibers and to be more important for the sense of smell than are the median striae.

Anosmia from Contrecoup Head Injuries

Loss of the sense of smell following injuries to the back of the head or neck should be ascribed to contrecoup action on the olfactory fibers lying on the under surfaces of the frontal lobes.

Goland said (1) that the lateral olfactory striae and the anterior portion of the hippocampal gyri might conceivably be lacerated in a contrecoup injury against the shelving edge of the lesser wings of the sphenoid bone on one or both sides and (2) that in a contrecoup injury of the brain the fine olfactory fibers, being exposed on the under surfaces of the frontal lobes, must come in for a greater degree of injury than if they were buried deep in the substance of the frontal lobes.

PATHWAY OF GUSTATORY SENSATION TO THE PONS

The pathway of gustatory sensation to the pons depends on the age of the patient, disturbances of the sense of taste referable to the tensor tympani muscle playing a varying part.

Schwartz and Wendel suggested that the sense of taste may be transmitted by two distinct routes.[18]

In the great majority of cases the nerve impulse follows the route of Lussana.

I. Starting from the anterior two thirds of the tongue, the impulse passes along (*a*) the lingual nerve, (*b*) the chorda tympani, (*c*) the facial nerve and (*d*) the geniculate ganglion, to reach the brain stem by (*e*) the nervus intermedius of Wrisberg.

II. However, the greater superficial petrosal nerve may form a part of the pathway from the anterior two thirds of the tongue in exceptional cases. In this event the gustatory impulses pass from (*a*) the chorda tympani via (*b*) the otic ganglion and (*c*) the internal sphenoid nerve to reach (*d*) the greater superficial petrosal nerve, from which point they are carried via (*e*) the geniculate ganglion and (*f*) the nervus intermedius into the pons.

The second theory is based on the observation of loss of taste sensation in a patient after excision of the greater superficial petrosal nerve and of the preservation of taste in 2 patients after section of the chorda tympani.

Moruzi and Lechintski's [18] contribution is based on 5 recent cases.

Their second, third and fourth were cases of purulent otitis media with involvement of the mastoid, in all of which extensive mastoidectomy caused complete destruction of the chorda tympani.

In the second case, that of a man aged 28, the sense of taste was completely abolished in the anterior two thirds of the tongue on the affected side, thus confirming Lussana's theory. In cases 3 and 4, cases of children aged 13 and 8 years respectively, there was evidence of a complementary route for transmission of taste, since destruction of the chorda tympani resulted only in a diminution (more marked in the older child) of a sense of taste in the anterior two thirds of the tongue on the affected side. Likewise, in case 5, that of a boy aged 6 years, destruction of the chorda tympani as a result of operation for chronic otorrhea on the right side did not produce complete loss of taste on that side.

Their first patient had trigeminal neuralgia. Interruption of the superior and inferior maxillary nerves at the level of the gasserian ganglion by operation did not disturb the sense of taste.

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18. Moruzi, A., and Lechintski: Quelques observations au sujet des voies de transmission des sensations gustatives chez l'homme, Rev. neurol. **70**:478-483 (Nov.) 1938; abstracted, Neuro-Psychiatric Institute of the Hartford Retreat, ser. 7, no. 16, Jan. 23, 1939.

On the basis of these apparently contradictory findings the authors suggested the possibility that the pathways transmitting taste impulses undergo a progressive differentiation during childhood and adolescence. They stated that in the young child a certain number of taste fibers do not accompany the other fibers along the chorda tympani but leave the lingual nerve, perhaps by the third route postulated by Schwartz and Wendel, to rejoin the first group of fibers at the level of the geniculate ganglion.

This would explain why disturbances in the sensation of taste occurring after section of the chorda are more marked in older children and also why in the great majority of adults after section of the same type the sense of taste is lost. In the rare cases in which it is preserved, the fibers which pass along the great superficial petrosal nerve are evidently capable of transmitting the impulse partially or even completely.

ANATOMY OF PHARYNGEAL PITUITARY GLAND AND ITS PHYSIOLOGIC RELATIONS TO THE PITUITARY GLAND

Specimens of pharyngeal pituitary gland obtained at autopsy in 54 unselected cases were studied by Melchionna.[19] In 51 of the 54 specimens the pharyngeal pituitary gland was located microscopically, a study of the pituitary gland proper being included.

Situation and Variations in Size

The pharyngeal pituitary gland is most constantly located in the midline, deep in the mucosa contiguous to the periosteum, at a point where the periosteum is firmly attached to the vomer-sphenoid articulation. It often shows irregular cords extending outward from the main mass of cells in various directions. It is very small; the largest gland observed measured but 6.62 by 1.5 by 0.35 mm.; the smallest was but 0.36 by 0.1 by 0.21 mm. It appears that there is no progressive evolution of this structure during life.

Cellular Structure

The pharyngeal pituitary gland is composed essentially of two types of cells: (1) epithelial cells and (2) differentiated cells similar to those in the anterior lobe of the pituitary gland.

Epithelium was present in 33 of the 51 glands examined. It was usually of the transitional type, arranged in small nests with an indefinite basal layer. In this gland there is no progressive differentiation of the cells, such as is observed in other functional organs.

The differentiated tissue in the pharyngeal pituitary gland has the same microscopic appearance as that in the pituitary gland. The aci-

19. Melchionna, R. H.: The Pharyngeal Pituitary Gland, Arch. Path. **25**:505 (April) 1938.

dophils and basophils, respectively, were entirely absent in 2 of the glands; in others, in which the cells were present, their number was small.

Melchionna concluded that it is unlikely that the pharyngeal pituitary gland contributes any significant physiologic function under normal conditions of growth and activity; but in some cases of alteration in the activity or in the structure of the pituitary gland the pharyngeal pituitary gland may undergo structural alteration and serve as an endocrine organ.

THEORIES OF SPONTANEOUS RHINORRHEA

Livini [20] found that up to 1934 66 cases of cerebrospinal rhinorrhea had been reported in the literature. He added 1 case of his own. One theory (*a*) attributes spontaneous rhinorrhea to a congenital craniopharyngeal canal forced open by violent coughing or sneezing. Another (*b*) is that the cerebrospinal fluid tracks down the perineural sheaths of the olfactory nerves.

RHINORRHEA TREATED BY SYMPATHECTOMY

In a case reported by Hall [21] intractable rhinorrhea was treated by sympathectomy.

> The biochemical examination of the nasal secretion showed: protein, 125 mg. per hundred cubic centimeters; chlorides, 462 mg., and sugar, 49 mg.
>
> Mr. Dott, a consultant, was of the opinion that the condition was not cerebrospinal rhinorrhea but a transudation of the nasal mucous membrane. As local measures had had no effect, Mr. Adamson, a second consultant, produced Horner's syndrome on the right side by injection of procaine hydrochloride in order to observe its effect on the nasal secretion. The nose was completely dry for twelve and a half hours after this injection. The anesthetic was then injected on the right side, without improvement.
>
> As "there had been a dramatic improvement following the injection of the sympathetic," it was proposed to do ganglionectomy. On April 15, 1937, Adamson carried out this operation on the right side. On November 16 a cervical ganglionectomy was done on the left side. Three days later the nose was almost completely dry, although at the time of presentation of the report it was not absolutely dry.

In the discussion, Kelly said that this case differed from the usual cases of vasomotor rhinitis in that no sneezing or intermittent obstruction was present and the intranasal appearance was normal. Referring to cases of his own in which there was a clear discharge, he expressed the belief that the cause "in one instance was the daily inhalation of a

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20. Livini, S.: Spontaneous Cerebrospinal Rhinorrhea, Brit. M. J. **1**:1208 (June 4) 1938; abstracted, Arch. Otolaryng. **30**:120 (July) 1939.

21. Hall, I. S.: Intractable Rhinorrhea Treated by Sympathectomy, J. Laryng. & Otol. **54**:215-216 (April) 1939.

foul smell from a collection of rags and bones, and in another from handling—not imbibing—alcohol."

HALLUCINATIONS

SITUATION OF CENTRAL PATHWAYS FOR VISION AND AUDITION

The pathways of vision and audition are widely separated at their origins and at their terminations but are close together at (*a*) the colliculi (the superior and inferior eminences; [quadrigeminal bodies]) and (*b*) the geniculate bodies. This anatomic fact may help to explain intersensory connections and particularly the symptom called "synesthesia"—"the experience of a sensation in one place, due to stimulation applied to another place."

Quercy and de Lachaud [22] studied the commissure of Gudden—which forms the commissura inferior in the tuber cinereum just behind the optic chiasm (Stedman); it is also called the arcuate commissure, which is the inner and upper fibers of the optic tract (Dorland). The optic tract terminates with subdivision into two parts, one for each geniculate body, which seems grossly apparent in human beings; however, serial sections show that the entire optic tract ends in the lateral geniculate body.

TYPES OF HALLUCINATIONS

De Morsier [23] has discussed olfactory, gustatory, visual, vestibular and combined auditory and verbal hallucinations.

Olfactory Hallucinations

The presence of olfactory hallucinations indicates a lesion in the region of the uncus (uncus gyri hippocampi). The odors complained of are always disagreeable and occur in crises. Anosmia does not accompany olfactory hallucinations.

Olfactory hallucinations often appear with infiltrating tumors of the temporal lobe. They appear as an aura of epileptic seizures and in cases of cranial traumatism but are rare in cases of toxic infectious conditions and of chronic hallucinatory psychosis.

Gustatory Hallucinations

Gustatory hallucinations occur in crises and are sometimes associated with other hallucinations and with motor crises.

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22. Quercy, P., and de Lachaud, R.: Etudes sur les voies visuelles et auditives; la commissure de Gudden, Encéphale **31**:61-72 (June) 1936; abstracted, Arch. Neurol. & Psychiat. **39**:187 (Jan.) 1938.

23. de Morsier, G.: Les hallucinations; étude oto-neuro-ophtalmologique, Rev. d'oto-neuro-opht. **16**:241-252 (April) 1938; abstracted, Arch. Neurol. & Psychiat. **41**:1044-1046 (May) 1939.

Visual Hallucinations Associated with Vestibular Disturbances

Chemical excitants when ingested may produce visual hallucinations with associated vestibular disturbances, for the vestibular function exercises considerable influence on the visual function. If the lesion involves the parieto-occipital convexity (area 19) but not the anterior and inferior faces of the cuneus, a visual hallucination may be accompanied by spasmodic deviation of the head and eyes to the side opposite the lesion.

"Acouphènes"

Acouphènes, as the French call "head noises of nervous origin," may arise from a stimulant acting anywhere along the course of the acoustic pathway. The "noise" is located by the patient as being near the ear or in the head. In auditory hallucinations the noises seem to the patient (*a*) to be outside himself and (*b*) to have a significance which ordinary tinnitus does not possess. They are real voices. Auditory hallucinations are always indicative of a lesion of the cortical auditory sphere.

Auditory and Verbal Hallucinations

Just as auditory agnosia (inability to recognize the import of the stimuli) and verbal (word or speech) deafness are almost always associated, so auditory and verbal hallucinations may occur together. If the para-auditory zone (convexity of the temporal lobe), which in the normal state exercises an inhibitory effect on impulses coming from the auditory area, is diseased, superfluous impulses may radiate into the surrounding zone and produce hallucinations.

Slow compression of the temporal lobe by a tumor of the parietal lobe may produce verbal hallucinations associated with disturbances of auditory and verbal gnosis (perception). Hallucinations in the course of dementia paralytica have been observed more frequently since the advent of malarial therapy.

Auditory and verbal (speech) hallucinations occur in association with vascular lesions and tumors of the temporal lobes, epileptic auras and crises of forced movements, inflammatory conditions of the brain, chronic alcoholism, cocaine intoxication and other intoxications, pernicious anemia, intracranial hypertension, chronic hallucinatory psychosis and schizophrenia.

Hallucinations in General

Hallucinations have an important localizing value. Different sensory hallucinations are conditioned by disturbances situated in different cerebral territories. These territories are situated around the zones of projection of the corresponding sensorial pathways.

When various hallucinations coexist, the disturbances involve several sensorial zones simultaneously.

I have seen auditory and visual hallucinations associated with a deep-seated abscess of the brain following a septic infarct.[24] The hallucinations were interpreted by the consulting neurologist as of toxic origin.

Combination of Auditory and Visual Hallucinations with a Lesion of the Upper Portion of the Peduncle and Subthalamic Regions

Lhermitte, Delthil and Garnier [25] presented a case of a lesion of peduncular origin whose importance was in the appearance of sensory, auditory and visual hallucinations. This occurred in a patient with a lesion of the upper portion of the peduncle and the subthalamic region and appeared years after the onset of abnormal movements of the limbs.

A woman of 71 had been in the hospital thirteen years, with a disorder of motility in the left extremities which dated from 1901. In 1905 a diagnosis of Weber's syndrome—the association of hemiplegia with paralysis of the third cranial nerve or part of the third cranial nerve of the opposite side, due to a lesion of one of the crura cerebri—had been made. At the time of examination, in 1937, the paralysis of the third nerve on the right side was no longer appreciable, but there was paralysis of the upward gaze (evidence of a dissociated Parinaud syndrome—viz., paralysis of conjugate upward movement of the eyes without paralysis of convergence, which is usually the result of a lesion of the midbrain).

She had an incessant muscular agitation of the left upper and lower limbs which was similar to choreic movements and to rhythmic trembling of Benedikt's syndrome—paralysis of the parts supplied by the oculomotor nerve of one side with paresis and tremor of the upper extremity of the other side.

The hallucinations first occurred during the night, when the patient heard steps approaching and, looking up, saw the white silhouette of a nurse, which disappeared when spoken to. She then realized that the image was a hallucination. Later she was convinced of the reality of the objects. On two occasions the patient had had hallucinations in which men and women in black were all around her and *spoke to her*. At the time she was sure that the images and voices were real. However, she had a good critical sense of these phenomena and displayed no alarm about them, but simply astonishment.

The symptoms suggested to the authors a lesion affecting the subthalamic region on the right side (especially the high part of the red nucleus), touching the nuclei of the posterior commissure, the patient having a "contralateral syndrome of the red nucleus" of unknown origin.

Lhermitte and Levy have observed 2 other cases of the same type, each marked by the association of muscular disorders referable to a lesion

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24. Eagleton, W. P.: Brain Abscess: Its Surgical Pathology and Operative Technique [case 17], New York, The Macmillan Company, 1922, pp. 77-81.

25. Lhermitte, J.; Delthil, and Garnier: Syndrome contralatéral du noyau rouge avec hallucinations visuelles et auditives, Rev. neurol. **70**:623-628 (Dec.) 1938; abstracted, Neuro-Psychiatric Institute of the Hartford Retreat, ser. 7, no. 38, Feb. 17, 1939.

of the upper part of the cerebral peduncle and the region of the subthalamus with hallucinatory phenomena.

The authors pointed out that in most cases of "peduncular hallucinations" the phenomena affect only the visual spheres. However, in this patient they were both visual and auditory, so it was not possible to ascribe them to the existence of a stimulus affecting some segment of the visual apparatus alone. The case illustrates the difficulty of separating true hallucinations from "hallucinosis."

Combination of Olfactory and Gustatory Hallucinations with Tumor of the Temporal Lobe

Brun [26] reported 2 cases of tumor of the temporal lobe associated with olfactory and gustatory hallucinations. Perversions and hallucinations of smell and taste are of definite significance in diagnosis of lesions of the basal and medial portions of the temporal lobe (the hippocampi, the uncinate gyri and the nucleus amygdalae—"a small mass of subcerebral gray matter under the tip of the temporal lobe, anterior to the lateral ventricle end of the descending cornu of the lateral ventricle").

Anosmia and hyposmia are not found in connection with central or cortical lesions of the olfactory or gustatory centers and consequently are of no diagnostic significance in localization of lesions of the temporal lobe.

Keschner, Bender and Strauss [27] stated that complex visual and auditory hallucinations are more frequent in patients with tumor of the temporal lobe. Crude auditory hallucinations are most common on the side of the tumor, whether the tumor is located above or below the tentorium.

INTRACRANIAL COMPLICATIONS

Combined Rhinologic and Otologic Suppuration as a Cause of Intracranial Complications

Rhinologic Suppuration with Complicating Otitis as the Cause of Intracranial Complications

Courville and Rosenvold,[28] in a study of 15,000 autopsies, reported 62 cases of intracranial complications from infections of the nasal cavities

26. Brun, R.: Troubles de l'odorat et du gout comme signe d'une lésion focale du lobe temporal, J. belge de neurol. et de psychiat. **37**:262-269 (April) 1937; abstracted, Arch. Neurol. & Psychiat. **39**:1324-1325 (June) 1938.

27. Keschner, M.; Bender, M. B., and Strauss, I.: Mental Symptoms Associated with Tumor of the Brain: Study of 530 Verified Cases, J. A. M. A. **110**: 714-718 (March 5) 1938.

28. Courville, C. B., and Rosenvold, L. H.: Intracranial Complications of Infections of Nasal Cavities and Accessory Sinuses, Arch. Otolaryng. **27**:692-731 (June) 1938.

and the accessory sinuses. In 11 of the 62 cases it was questionable what lesion was the source of the intracranial disease, as in addition to the rhinologic suppuration there was associated otitis media.

Comment by Reviewer: It is my experience that otitis complicating an otherwise quiescent suppuration of the nasal sinuses or the reverse, that is, the occurrence of acute rhinitis in the presence of a symptomless chronic otitis media, predisposes to an intracranial involvement.—W. P. E.

In 14 cases frontal sinusitis was the cause of intracranial suppuration; there were 6 cases of subdural abscess, 2 cases of cerebral abscess, 2 cases of septic thrombosis of the superior longitudinal sinus and 4 cases of extradural abscess.

Ethmoiditis was the cause in 18 cases and sphenoiditis in 22 cases. In many instances both sinuses were involved.

There were 3 cases of thrombosis of the cavernous sinus, sphenoiditis being present in all.

In 3 other cases the thrombosis of the cavernous sinus was due to infectious lesions (boils or ulcerations) in the nares. Infection of the maxillary sinus was responsible for 4 of the intracranial lesions.

Predominance of Acute Lesions as a Causative Factor

Rhinogenic intracranial complications most frequently result from an acute lesion, in contrast to otogenic intracranial complications, which are most often due to chronic otitis.

Ethmoiditis as a Cause of Intracranial Complications

Of Schreyer's [29] 19 patients with orbital complications secondary to sinusitis, 2 had cerebral complications. In the literature the frontal sinus is stated to be the starting point of the cerebral complication. However, this author asked: Is not the ethmoid bone, with its labyrinthine cavity system and its extensive vicinity to the brain and the lamina cribrosa, more frequently a route of transmission than is the frontal sinus?

Comment by Reviewer: In a forthcoming book, "Cranial Bone Suppuration in Relation to Meningitis," I make the following statement, an answer to Schreyer's question:

"Mechanisms for Protection of the Cerebral Surface of the Ethmoid Capsule.—That part of the ethmoid capsule which is adjacent to the dura is made up of plates (lamellae) of compact bone. For the cribriform plate (the olfactory domain) of the ethmoid capsule is a special-sense bone. There is no bone marrow in those olfactory laminae *which are adjacent to the dura.* Compact bone does not harbor infection and therefore meningitis from ethmoiditis of the anterior and middle cells is practically non-existent.

29. Schreyer, W.: Ueber orbitale Komplikationen der Nasennebenhöhlenentzündung, Ztschr. f. Hals-, Nasen- u. Ohrenh. **41**:432-442, 1937.

"Dehiscences in the ethmoid roof, although "frequent in the lamina papyracea" (Schaeffer), occasion meningitis only in patients traumatized by operation. This is for the reason that, although the bone is missing, the external layer of the dura is covered by mucous membrane, which is a protective mechanism for the nose."—W. P. E.

Microscopic and Clinical Pathways of Cerebral Infections from the Nose and Face

Kramer [30] stated that the following conditions have been definitely demonstrated both clinically and "by microscope" as constituting pathways of infection from the paranasal sinuses to the meninges: (*a*) osteitis, (*b*) osteomyelitis and (*c*) phlebitis. One or a combination of these three processes may spread through (*a*) dural and neural polyps; (*b*) defects in the cranial walls of the sinuses; (*c*) the perivascular lymph space or (*d*) the perineural lymph space.

Pathways Lacking Microscopic Proof.—On the other hand, Kramer stated that there is clinical evidence but not microscopic "proof" that infection may originate in a number of ways: 1. From an orbital infection secondary to sinusitis, the infection extending into the cranium either (*a*) by vascular involvement or (*b*) by direct purulent or cellulitic spread through the orbital fissures. 2. Following involvement of the pterygomaxillary fossa from sinusitis, with extension either through the basal foramens or by vascular pathways. 3. By extension from the maxillary sinus from osteomyelitis of the superior maxilla, by way of the orbit or the frontal bone or by vascular pathways. 4. As a result of metastasis from a distant focus, which may cause osteomyelitis of the walls of a paranasal sinus and thus extension to the meninges.

Intracranial Complications from Sinal Suppuration

In 1936, Hagerup [31] reported that at the Municipal Hospital of Copenhagen, Denmark, from 1906 to 1934 only 33 patients had spontaneously developing intracranial complications in over 1,300 cases of inflammation of the nasal accessory sinuses.

Importance of Operative Trauma.—There were 2 cases in which an intracranial complication of sinusitis developed from operative trauma and 1 in which such a complication followed cerebral injury with involvement of the frontal sinus.

High Mortality from Rhinologic Intracranial Complications.—In 14 cases of leptomeningitis (in 2 associated with subdural abscess) only

30. Kramer, R.: Pathways of Infection from the Paranasal Sinuses, Laryngoscope **47**:304-305 (May) 1937.

31. Hagerup, G.: The Rhinogenous Intracranial Complications: On Basis of Material of Department for Diseases of the Ear of Municipal Hospital, Copenhagen, Acta oto-laryng. **24**:321-378, 1936.

6 patients recovered, while 8 died. There were 12 cases of cerebral abscess; all but 1 were fatal. All of 3 patients with cavernous sinus thrombosis died.

Nasal Sinus Involved.—In 20 of the 33 cases of spontaneous intracranial complications, these complications originated from the frontal sinus, in 9 from the ethmoid cells, in 3 from the sphenoid sinus and in 1 from an undetermined source.

Infrequency of Definite Signs Early in the Disease.—Of the 33 cases, definite symptoms of intracranial involvement were present in only 8 at the time of the patient's admission to the hospital.

INTRACRANIAL COMPLICATIONS OF CRANIAL OSTEOMYELITIS

MENINGITIS FROM UNRECOGNIZED OSTEOMYELITIS OF THE PETROUS PYRAMID

Barth [32] reported a case of isolated osteomyelitis of the petrous pyramid with rupture into the internal auditory meatus. He assumed that an attack of acute otitis media running a mild course was the most probable cause of the osteomyelitis. The focus in the apex was not connected with the pneumatic cell system but was the result of an infection of the blood route or of the lymphatic system.

Comment by Reviewer: As I pointed out in 1930,[33] osteomyelitis of the apex generally originates in the blood stream, extension from the otitic focus occurring by thrombophlebitis of the small veins, in which case no "tract" is formed until the disease has existed for a long time.—W. P. E.

CONTRALATERAL OPTIC NEURITIS DUE TO COMPRESSION FROM SUPPURATION OF THE SPHENOID SINUS

Balzano [34] studied the anatomic relations of the sphenoid sinus and the communications between the sphenoid sinus and the subarachnoid space.

In a case of sphenoid sinusitis with optic neuritis on the right side and extension into the cisterna perilymphatica, causing secondary compression of the left optic nerve, he observed microscopic "hypertrophic changes of the mucosa, with great distinction of the vessels, and formation of polyps."

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32. Barth, H.: Isolierte, klinisch nicht festgestellte Pyramidenspitzeneiterung mit tödlichem Ausgang, Hals-, Nasen- u. Ohrenarzt (pt. 1) **28**:358-364 (Dec.) 1937.

33. Eagleton, W. P.: Unlocking the Petrous Pyramid for Localized Bulbar (Pontile) Meningitis Secondary to Suppuration of the Petrous Apex: Report of Four Cases with Recovery in Three, Arch. Otolaryng. **13**:386-422 (March) 1931.

34. Balzano, I.: Sinusite sfenoidale e diffusioni flogistiche periottiche e meningee, Oto-rino-laring. ital. **1**:351-387 (Aug.) 1937.

Suppuration of the Sphenoid Sinus, the Most Frequent Cause of Rhinogenic Meningitis

Hirsch [35] stated that the most common endocranial complications of diseases of the accessory sinus are meningitis and abscess of the brain, the next in order of frequency being extradural abscess and phlebitis of the cavernous sinus. He expressed the belief that rhinogenic meningitis is most commonly caused by suppuration of the sphenoid sinus. In nearly 50 per cent of all Hirsch's cases of cerebral complications referable to the frontal sinus these complications were abscesses.

Poor Late Results with Abscess of Frontal Lobe.—Drainage of an abscess of the frontal lobe frequently results in apparent cure, but permanent cure is rare. Hirsch's longest known cure has existed but six years.

Cranial Osteomyelitis of Chronic Otitic Origin Causing Abscess of the Temporal Lobe

Wentlandt [36] reported a case of osteomyelitis of the flat temporal squama with subperiosteal abscess and abscess of the temporal lobe in a boy aged 10 years who had suffered from a discharging ear for five years.

Cranial Osteomyelitis Following Suppuration of the Frontal Sinus

Apffelstaedt [37] contributed a summary of 7 cases of cranial osteomyelitis complicating suppuration of the frontal sinus.

As spongy bone is almost invariably found where the posterior and the anterior wall of the frontal sinus meet above, it is here that the disease generally begins. Furthermore, as the marrow substance is more extensive in youthful than in aged persons, osteomyelitis is more frequent during youth. Invasion of the marrow having occurred, the following factors may enter into its distribution: (1) the loose-meshed structure of the bone marrow and (2) the well developed venous system. The peculiar anatomic structure of Breschet's veins favors the distribution of the process, for, although the vessels become thrombotic, complete occlusion of their lumens does not develop, the vessels consisting only of a thin intima which is firmly attached to the bone. Accordingly, as the thrombus lies free in the rigid-walled vessel, it is apt to extend or

35. Hirsch, O.: Nebenhöhlen und Gehirn, Wien. klin. Wchnschr. **51**:116-117 (Jan. 28) 1938.

36. Wentlandt, H.: Chronic Otitis, Osteomyelitis of the Temporal Squama as Well as Subperiosteal and Temporal Lobe Abscess, Thesis, Hamburg, 1937, p. 16.

37. Apffelstaedt, O.: Beitrag zum Krankheitsbilde der Osteomyelitis crani rhinogenen Ursprungs, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **144**:315-336, 1938.

be carried beyond the sutures into another bone, forming a new focus. The frequency of endocranial complications thus becomes explainable.

This author expressed the belief that in the operative procedure for osteomyelitis the dura should be exposed but the periosteum preserved as far as possible. And in his hands this procedure has been successful, as in the 7 reported cases only 1 patient died.

INTRACRANIAL COMPLICATIONS FROM OTITIS

Intracranial Complications from Otitis Media

Of 970 patients with acute or chronic inflammation of the middle ear treated in the otolaryngologic clinic at the University of Lwów. (Poland), 141 had intracranial complications (Jankowski).[38]

Age Incidence.—The frequency of intracranial complications in patients over 50 was three times as great as in patients between 40 and 50 years of age.

Acute Otitis.—Acute inflammation of the middle ear was complicated by meningitis in 13 per cent and by abscesses in the temporal lobe and in the cerebellum in 9.4 per cent of the cases. Death occurred in 5.7 per cent of all the cases of acute otitis.

Relative Frequency of Death from Chronic and from Acute Otitis.—Chronic suppuration of the middle ear caused death in 12 per cent of the cases. Thus, the mortality in complicated cases of chronic inflammation was twice as high as in complicated cases of acute inflammation of the middle ear.

Chronic inflammation of the middle ear gave rise to inflammatory processes of the dura in 8.4 per cent of the cases and to leptomeningitis and abscess of the temporal lobe in 2.3 per cent.

Surgical Importance of Petrosquamous Sinus in Production of Intracranial Complications During Infancy

The importance of the petrosquamous sinus in tympanoantral infections has been overlooked. This is because the sinus does not persist in the adult. In infancy and childhood, however, the petrosquamous sinus should always be considered, as it brings about the anastomosis of the veins of the middle ear and those of the meninges. Inflammatory products may be carried directly from tympanoantral suppuration through the petrosquamous sinus and result in an endocranial lesion without macroscopic changes in the bone.[39]

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38. Jankowski, W.: Intracranial Complications of Otitis Media, Polska gaz. lek. **17**:519 (June 19); 549 (June 26); 568 (July 2) 1938; abstracted, Zentralbl. f. Hals-, Nasen- u. Ohrenh. **31**:76, 1938.

39. Sutherland, J. M.: Otogenous Sinus Thrombosis, Arch. Otolaryng. **27**: 1-34 (Jan.) 1938.

Anomalies of the Venous Sinuses as Factors in Production of Cerebral Symptoms

Sutherland [39] pointed out that in the presence of otitic sinus thrombosis anomalies in the lateral sinus may cause an interference with the collateral circulation and produce cerebral symptoms of back pressure. Furthermore, atypical symptoms in the presence of endocranial disturbances may be due to anomalies of the sinus structure.

Effect of Sudden Occlusion of a Large Sinus

Sudden occlusion of a large sinus or of the jugular vein causing obstruction of the superficial cerebral vein may produce venostasis of the cortex.[40]

From a series of corrosion preparations Batson has demonstrated many intercommunications of the venous system, with extensive endocranial ramifications which do not lend themselves to any surgical treatment.

Comment by Reviewer: In 1906 I reported a case of thrombosis of the jugular bulb in which intracerebral venous stasis with immediate papillary stasis and almost total blindness arose from ligation of an internal jugular vein.[40] The venous stasis occurred because the ligated jugular vein was the main vessel for the return of blood from the cranial cavity—the opposite jugular foramen being very small—and because the superior longitudinal sinus was occluded by thrombosis. The thrombus was probably dislodged during operative manipulation of the sinus. I offered the suggestion at that time that the intense papilledema probably originated in part from an associated acute internal hydrocephalus due to increase of the cerebrospinal fluid from irritation. The increased amount of cerebrospinal fluid with the diminished outflow resulted in acute distention of the ventricles in addition to the venous stasis.

The blindness, after persisting for several days, was relieved by rupture of the dura and by development of a hernia cerebri. At autopsy the lateral sinus on the opposite side was found to be of very small caliber.[41]—W. P. E.

COMPLICATIONS FOLLOWING LIGATION OF CAROTID ARTERIES

Ligation for Nasal Hemorrhage

In view of the high mortality and occasional serious cerebral complications following ligation of the carotid arteries in cases of intractable nasal hemorrhage, Fetterman and Pritchard [42] emphasized ligation of the external carotid artery only, for the major blood supply of the nose comes only from branches of that artery. The hazards from ligation of the carotid arteries are illustrated in the case cited by the authors.

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40. Eagleton, W. P.: Circulatory Disturbances Following Ligation of the Internal Jugular Vein in Sinus Thrombosis, with Report of Case, Arch. Otol. **25**:91-102 (April) 1906.

41. Eagleton,[40] case 23, p. 129.

42. Fetterman, J. L., and Pritchard, W. H.: Cerebral Complications Following Ligation of the Carotid Artery, J. A. M. A. **112**:1317-1322 (April 8) 1939.

K. L., aged 37, was admitted to the hospital in November 1936, because of right hemiplegia. In February 1936 a profuse nasal hemorrhage from the left nostril developed during shaving. The hemorrhage continued despite blood transfusions, and both the external and the internal carotid artery on the left side were ligated. Two and one-half hours later right hemiplegia occurred, with difficulty of speech and swallowing. Other major symptoms besides the hemiplegia were hemianesthesia, aphasia, convulsions and impairment of intelligence. Several months later the patient died of a serious intestinal lesion.

At necropsy the cerebral symptoms were found to have been due to marked atrophy of the left hemisphere, particularly in the parietal areas and the structures supplied by the middle cerebral artery. For the physiopathologic basis of the cerebral lesion several factors were found including arteriosclerosis, absence of the posterior communicating artery and severe general anemia prior to ligation.

Comment by Reviewer: In 1926 [43] I reported a case of hemiplegia following ligation of the common carotid artery, with a review of the literature, and another case of hemiplegia from double ligation. Since then I have practiced fractional ligation when necessary, with the use of fascia lata and have not had an accident. —W. P. E.

Surgically Important Abnormalities of the Lateral Sinus

Anomalies of the sigmoid portion of the lateral sinus were noted by Ruttin.[44] One specimen showed an extremely wide sigmoid sinus which ended in a blind sac. It did not continue as the transverse sinus, a small transverse sinus and a small superior petrosal sinus terminated in the sac. This sinus reservoir had a narrow body canal for the internal jugular vein; the jugular bulb was absent.

The other specimen showed the upper knee of the sigmoid sinus containing a blind pocket. In this case Ruttin found at autopsy a narrow sagittal and transverse sinus on the right side, both communicating with the confluens sinuum; the straight and occipital sinuses were large.

Smith [45] reported a case of disturbance of the return cerebral circulation from ligation of one jugular vein, which was followed by "operation occlusion" of the opposite sinus some time later.

A boy 10 years of age was apathetic and toxic on admission to the hospital. The temperature was 106 F.

On January 7 bilateral simple mastoidectomy was done. The following day the boy had a chill. Culture of the blood yielded hemolytic streptococci. Two days after the operation he seemed slightly less drowsy but complained of intermittent headache and was restless.

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43. Eagleton, W. P.: Cavernous Sinus Thrombophlebitis, New York, The Macmillan Company, 1926, pp. 135 and 163.

44. Ruttin, E.: Kloaken- und Blindsackbildung am Sinus sigmoideus, Aus der Universitätsklinik für Ohren-, Nasen- und Kehlkopfkrankheiten in Wien, Vorstand des Ohrenambulatoriums am Rudolfspital in Wien, cited by Sutherland.[39]

45. Smith, M. T.: Thrombophlebitis of the Lateral Sinuses Complicating Bilateral Acute Mastoiditis, Arch. Otolaryng. **29**:533-543 (March) 1939.

On January 10 there was severe pain in the right elbow. On January 15 ligation of the right internal jugular vein below the level of the facial vein was done. The right lateral sinus was blocked by a well organized clot; there was no bleeding from its bulbar end.

The patient remained drowsy and appeared toxic. On January 22 operation was done on the left lateral sinus. As blood was obtained by a hypodermic needle inserted into the left sinus, the sinus above the knee and at the lower end was blocked off. As there was no evidence of a thrombus in the vein in the exposed area, the jugular vein was not tied.

Following the operation on the left side, signs of increased intracranial pressure appeared. Headache at the end of five days was intense. The boy was restless and vomited occasionally.

On January 27 the patient was drowsy but well oriented and cooperative. The deep reflexes on the right were accentuated and there was generalized hyperesthesia, with a suggestion of Kernig's sign on the right side. Bilateral papilledema with tortuous dilated veins was observed, more marked on the left.

On January 29 there was increase in the papillary edema, with small hemorrhages.

On February 1 spinal tap showed a clear fluid under pressure; there were 4 cells per cubic millimeter; small amounts of albumin and globulin were present, and there was normal reduction of Fehling's solution.

The severe headache persisted until February 19, but after each spinal tap the patient had some relief for a few hours. The decrease in the headache ran parallel to the decrease in the edema of the disks. Eight spinal taps were made in all.

Culture of the pus from the metastatic abscess in the right elbow showed a pure growth of the hemolytic streptococcus.

On February 26 the patient was happy and alert. A blood count showed 22,360 leukocytes per cubic millimeter, with polymorphonuclears 17 per cent, lymphocytes 83 per cent and young forms 42 per cent. A medical consultant considered the picture that of infectious mononucleosis. The patient was given a preparation of liver and stomach extract and iron (lextron) and halibut liver oil and was exposed to ultraviolet radiation.

On March 8 the disks still showed slight swelling of the margins.

Ultimate Diagnosis.—It was concluded that hemorrhages into the brain occurred as a result of the venous occlusion.

Comment by Reviewer: I am persuaded that cases of hemorrhage of the brain with venous stasis following ligation of the main internal jugular vein are much more frequent than is generally appreciated, as the majority of patients recover. The autopsies reported are few.[46]—W. P. E.

SIGNS AND SYMPTOMS OF INTRACRANIAL COMPLICATIONS

Bilateral Paralysis of the Abducens Nerve

According to Yaskin, Leavitt and Denison,[47] bilateral paralysis of the abducens nerve is observed with the following conditions:

1. The bilateral Gradenigo syndrome, a complication of sinus thrombophlebitis.

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46. Eagleton,[40] p. 42.

47. Yaskin, J. C.; Leavitt, F. H., and Denison, R. L.: Isolated Bilateral Paralysis of the Abducens Nerve: Report of Two Cases, Arch. Neurol. & Psychiat. **37**:1228 (May) 1937.

2. Intramedullary lesion of the brain when there is an associated implication of the seventh nerve and of the long sensory and motor pathways; the etiologic factor may be neoplastic or inflammatory, as is observed in disseminated encephalitis. The onset is usually gradual.

3. Syphilitic basal meningitis; in 150 cases of neurosyphilis, bilateral paralysis of the abducens nerve occurred 6 times.

4. Barbiturate intoxication.

5. Increased intracranial pressure as a symptom of tumor of the brain.

6. Facial diplegia, a congenital disease characterized by bilateral clubfoot, facial palsy and paralysis of the abducens nerve.

7. Lymphatic leukemia.

8. Cranial trauma.

H. D. W., a woman aged 51, had been deaf since late adolescence. Several members of the family on the paternal side were deaf. On Jan. 22, 1936, the patient's car skidded into a pole. On arriving at the hospital she had fracture of the maxilla and complete internal convergent strabismus. The spinal fluid was clear and normal.

Examination revealed complete bilateral paralysis of the external rectus muscle and nearly complete bilateral deafness.

The authors commented that this case can best be explained by assuming that the injury was in Dorello's canal, associated with subarachnoid hemorrhage sufficient to cause secondary meningitis.

Sedimentation Rate as a Diagnostic Aid for Serous Meningitis and Acute Encephalitis

Singer and Edel [48] found that determination of the sedimentation rate of the erythrocytes is valuable in differentiating (1) hydrocephalus (in which the sedimentation rate is normal) from cerebral tumor (in which this rate is slightly accelerated) and (2) serous meningitis (in which the sedimentation rate is normal) from (*a*) acute encephalitis (in which the rate is greatly increased) and (*b*) hemorrhagic pachymeningitis (in which the rate is moderately increased).

Clinical Significance of Changes in Cerebrospinal Fluid with Intracranial Complications from Suppurative Otitis

The report by Björk [49] is an analysis of the cerebrospinal fluid obtained in 389 lumbar punctures. Among 190 otologic cases there

48. Singer, E., and Edel, E.: Die Senkungsgeschwindigkeit als differentialdiagnostisches Hilfsmittel bei Hirnerkrankungen, Wien. klin. Wchnschr. **50**:406-408 (March 26) 1937.

49. Björk, H.: Untersuchungen über die Liquorverhältnisse bei der akuten Mittelohrentzündung und ihren Komplikationen, Acta oto-laryng., 1937, supp. 24, pp. 1-290.

were 3 cases of apicitis; 14 of labyrinthitis; 24 of thrombophlebitis; 3 of abscess of the brain, and 3 of general infection without demonstrable thrombophlebitis.

Fluid in Cases of Abscess of the Brain.—Björk's conclusions concerning the spinal fluid apply only to adults, as all the patients were between 18 and 24 years of age. In the 3 cases of abscess of the brain the spinal fluid findings were uniform. (*a*) The initial meningitis complicating the abscess was accompanied by pleocytosis, with a count of about 3,000 to 5,000 cells per cubic millimeter. (*b*) During the "manifest stage" of the abscess the fluid was clear (although an obvious increase was noted in the number of cells). (*c*) The *pressure* in 2 of the 3 cases was higher during the manifest stage than at the time of the initial meningitis.

Fluid in Cases of Meningitis.—The fluids in 145 cases were studied; 18 were purulent.

A relative polynucleosis indicates a progression, whereas a relative mononucleosis indicates "equilibrium" or a remission of the disease.

INTERNAL HYDROCEPHALUS

Nonsuppurative Intracranial Complications from Otitis Encephalitis; Otitic Hydrocephalus

In 1937, Williams [50] reported 4 cases of otitic hydrocephalus complicating otitis media and mastoiditis.

In 2 cases the symptoms suggested abscess of the temporal lobe without definite localizing signs. The spinal fluid was normal. Subtemporal decompression was done. Incision of the dura yielded clear fluids. No abscess was found. Both patients recovered.

In a third case, the condition was treated by ventricular puncture. Recovery was more rapid than in the other 2 cases. Microscopic study of cerebellar tissue removed by the puncture failed to show encephalitis.

In the fourth case the hydrocephalus was apparently chronic; it followed chronic otitis media, with a history of persistent headache for several years. A localized collection of pus was found in the cerebellum. The patient died soon after the operation.

Williams concluded that otitic hydrocephalus may be acute or subacute. The absence of pleocytosis may be the only finding which differentiates otitic hydrocephalus from abscess of the brain.

Most patients are successfully treated by thorough elimination of the infective focus and drainage by lumbar puncture. When symptoms persist, ventricular puncture is indicated.

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50. Williams, H. L.: Otitic Hydrocephalus, Arch. Otolaryng. **25**:632-652 (June) 1937.

Partial Preexisting "Occlusive State" as the Cause of Otitic Hydrocephalus in an Adult

In his later (1938) communication, Williams [51] expressed the opinion that otitic hydrocephalus may be caused by a preexisting pathologic condition which interrupts "the pathways of escape of the cerebrospinal fluid," and is aggravated by otitis, in which case a partial or complete "occlusive state" becomes active under the influence of a sudden edema or inflammation. Williams has expressed the belief that such a preexisting state is one of the basic factors of otitic hydrocephalus, especially in adults.

Pathologic Changes of Internal Hydrocephalus from Labyrinthitis

Kraus [52] reported the postmortem observations on a deaf-mute of 61 years who had had hydrocephalus since birth. The membranous labyrinths were affected as follows: 1. There was vestibular dilatation, and the perivascular and perineural lymph spaces of the modiolus of the cochlea were displaced. 2. There was deficient development of the vestibular portion of the ductus cochlearis. 3. Corti's membrane was sheathed with a nucleated covering.

Kraus's interpretation of the pathologic observations was that mild intrauterine serous meningitis had resulted in (*a*) hydrocephalus with (*b*) serous labyrinthitis. The continuous pressure within the brain resulted in the dilatation of the lymph spaces and did damage to the membranous labyrinth because it occurred while the internal ear was still in the stage of development.

Contralateral Paralysis of the Abducens Nerve in Otitic Hydrocephalus

Kelly's [53] patient with otitic hydrocephalus complicating mastoiditis and chronic otitis media had contralateral paralysis of the abducens nerve.

In addition to the paralysis of the sixth nerve there were attacks of vomiting and headache and marked papilledema. The cerebrospinal fluid was under greatly increased pressure—over 400 mm.—but was clear and practically normal.

A radical mastoidectomy followed by daily lumbar punctures led to recovery.

Kelly called attention to the fact that while homolateral paralysis of the sixth nerve is not unusual with either infection of the mastoid or otitic hydrocephalus, in this case the paralysis was contralateral.

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51. Williams, H. L.: The Underlying Factors Concerned in Otitic Hydrocephalus, Ann. Otol., Rhin. & Laryng. **47**:670-714 (Sept.) 1938.

52. Kraus, L.: Hydrozephalus und Innenohr, Hals-, Nasen- u. Ohrenarzt (pt. 1) **27**:64-80, 1936.

53. Kelly, D. B.: Otitic Hydrocephalus, Glasgow M. J. **129**:182-184 (April) 1938.

Comment by Reviewer: The anatomic explanation of contralateral as well as of homolateral paralysis of the abducens nerve as a complication of otitis with apical involvement was furnished by me in 1928, when I showed the great variations in (*a*) the size, (*b*) the length and (*c*) the position of Dorello's canal.[54]—W. P. E.

Difficulty of Differentiating Otitic Ventricular Hydrocephalus from Abscess of the Brain

A case of otogenic ventricular hydrocephaly was reported by Gritti.[55] He contended that a reliable differential diagnosis between hydrocephaly and abscess of the brain can be made but infrequently.

A man of 23 years suffered from a discharge of the right ear from infancy. Following a radical mastoidectomy, severe headache, chiefly frontal, and symptoms of pressure on the brain occasioned a diagnosis of temporosphenoid abscess. Puncture of the temporal lobe gave negative results. Puncture of the right lateral ventricle disclosed an increased amount of normal sterile fluid under pressure. Recovery followed.

VERTIGO, ENCEPHALITIS AND SINUS THROMBOSIS

AURAL VERTIGO

Influence of Fluid Balance on Ménière's Disease and on Hearing[56]

Dederding[57] and others have suggested that patients with Ménière's disease tend to retain fluid; but, as Crowe[58] pointed out, the question then arises why the symptoms should disappear on division of the vestibular nerve on the affected side alone. None of the patients under review tended to retain fluid unduly, although they were all sensitive to variations in the salt and fluid intake.

It is not unreasonable to suppose that an increase in the fluid content of the body may favor an increase in the intralabyrinthine pressure.[59]

Variations of the fluid content of the body are largely controlled by the salt intake. The most convenient antiretentional treatment is a diet

54. Eagleton, W. P.: Localized Bulbar Cisterna (Pontile) Meningitis, Facial Pain and Sixth Nerve Paralysis and Their Relation to Caries of the Petrous Apex, Arch. Surg. **20**:386-420 (March) 1930.

55. Gritti, P.: Idrocefalia ventricolare otogena, Boll. d. mal. d. orecchio, d. gola, d. naso **55**:287-300 (Aug.) 1937.

56. Cawthorne, T., and Fawcett, M. N.: Fluid Balance in Ménière's Disease, Lancet **2**:1404-1409 (Dec. 17) 1938.

57. Dederding, D.: Clinical and Experimental Examinations in Patients Suffering from Mb. (Morbus) Ménièri Including Study of Problem of Bone Conduction, Acta oto-laryng. (supp. 10) **1**:1-156, 1929; (supp. 11) **2**:1-213, 1929.

58. Crowe, S. J.: Ménière's Disease: Studies Based on Examinations Made Before and After Intracranial Division of Vestibular Nerve, Medicine **17**:1-36 (Feb.) 1938.

59. Hallpike, C. S., and Cairns, H.: Observations on Pathology of Mèniére's Syndrome, Proc. Roy. Soc. Med. **31**:1317-1336 (Sept.) 1938.

that partially restricts the fluid as well as the salt intake, with the addition, if necessary, of measures to encourage the excretion of salt and fluid. As a form of treatment it is only palliative and can never be considered curative. If the response to antiretentional treatment is favorable, it will enable the patient to lead a normal life or will at least afford relief to one who is a poor operative risk or assist him for a time.

The effect of various salt and fluid intakes on the symptoms of Ménière's disease was studied by Cawthorne and Fawcett [58] in 11 patients.

Dizziness and Vertigo.—1. All but 1 patient were influenced by variations in the intake of (*a*) fluid and (*b*) salt. 2. Any retention of fluid within the body resulted in an aggravation of the symptoms. 3. Lessening or disappearance of the symptoms occurred when excretion of fluid was encouraged. In 9 of the 11 cases fluctuation of the vertiginous symptoms was accompanied by variation in the hearing capacity; thus, when Ménière symptoms were more marked the hearing was worse, and vice versa.

The Pressure-Regulating Endolymph.—The author's explanation is that imperfect functioning of the pressure-regulating mechanism of the endolymphatic system places the affected labyrinth under the influence of any factor that may affect the secretion or absorption of endolymph on that side.

VESTIBULAR APPARATUS AND CEREBRAL VERTIGO

Early Vestibular and Auditory Symptoms of Tumor of the Fourth Ventricle

Otologists should realize that in the early stages of a tumor of the fourth ventricle disturbances of the eighth nerve occupy the first place, vestibular phenomena being more common than cochlear. On the other hand, in the later stages of tumor the development of a high degree of internal hydrocephalus, with papilledema and headache, usually masks all other symptoms.

In the case reported by Zimmermann and Tchernyschew,[60] the patient, aged 14, had shown vestibular and auditory symptoms two years previously. In addition to headache, there were (*a*) attacks of vertigo; (*b*) good hearing, with (*c*) shortened bone conduction; (*d*) spontaneous inward deviation of the arms; (*e*) a Romberg sign (falling backward); (*f*) postrotatory horizontal nystagmus of large amplitude toward either side, and (*g*) inverse past pointing. A test for falling and past pointing after douching gave normal results. Ten weeks before death the boy became blind owing to atrophy of the optic nerve following papillary stasis.

60. Zimmermann, G. S., and Tchernyschew, A. S.: Sur le syndrome anatomoclinique des tumeurs du quatrième ventricule du point de vue-neurologique, Rev. d'oto-neuro-opht. **14**:29-36 (Jan.) 1936; abstracted, Arch. Otolaryng. **25**:588-589 (May) 1937.

At autopsy a tumor (perithelioma) was seen on the ventral surface of the brain, between the cerebellum and the medulla. It compressed the right tonsil of the cerebellum and the median parts of the biventral lobule and the lobi graciles—which are the posterior part of the lobus biventralis and the anterior part of the lobus semilunaris—on both sides. The tumor had gradually filled the fourth ventricle, causing compression of the dorsal part of the pons, the tonsils and the tuber vermis.

Zimmermann and Tchernyschew interpreted the spontaneous inward deviation, the inverse deviation after stimulation and the nystagmus of wide amplitude as caused by functional disturbances of the nucleocerebellar fibers, the function of which is inhibitory. From the fact that the caloric test gave correct falling in the presence of the spontaneous inward deviations and from the other vestibular alterations observed, they concluded (1) that the pathway of the falling reaction does not pass by way of the vermis and (2) that, on the other hand, the static disturbances (falling backward and staggering gait) were due exclusively to changes in the vermis, as they were associated with a correct falling reaction to stimulation of the labyrinth.

Eagleton's Syndrome in the Diagnosis of Increased Intracranial Pressure

Collet and Mayoux [61] stated that "the Eagleton syndrome" (nonirritability to the cold caloric test of the vertical canals [vertical position of the head] in the upright position coinciding with normal irritability in the "horizontal canal position" of the head) plays a large part in the diagnosis of diseases of the posterior cerebral fossa.[62]

Comment by Reviewer: There is no doubt of the clinical value of the vestibular signs of increased intracranial pressure as first described by me in 1913. However, originally I made an error of interpretation. In recording the syndrome I should have stated, "loss of irritability in the *upright position*" (not "of the *vertical canal*") with induced nystagmus in the horizontal position of the head. For, while the effect is probably due to the "nonreactibility of the vertical canal," it is the description of the symptoms that constitutes the syndrome. This correction I published in 1921.[63]—W. P. E.

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61. Collet, F. J., and Mayoux, R.: A propos du syndrome d' Eagleton, J. de méd. de Lyon **17**:497-498 (July 20) 1936.

62. Eagleton, W. P.: Decompression for Relief of Disturbances of the Auditory Apparatus of Intracranial Origin: Report of Three Cases with a Previously Undescribed Aural Condition, Tr. Am. Otol. Soc. **12** (pt. 3):564-574, 1912; Laryngoscope **22**:592, 1913.

63. Eagleton, W. P.: (*a*) Aural Manifestations in Surgical Intracranial Lesions, read before Clinical Congress of Surgeons, Philadelphia, Oct. 25, 1921; (*b*) Value of Vestibular Manifestations in Surgical Intracranial Conditions, with Report of Four Cases, read at the Annual Meeting of the American Laryngological, Rhinological and Otological Society, Atlantic City, N. J., June 1921.

Collet and Mayoux' Case.—A woman aged 56 years had an illness which began with a "stroke" followed by a paralysis of the left facial nerve; violent headaches then appeared, with symptoms of progressive involvement of all the cranial nerves (except the optic nerve) of the left side.

Examination disclosed (*a*) anosmia of the left side; (*b*) complete immobility of the left eyeball, mydriasis, loss of the pupillary reflexes and left corneal anesthesia; (*c*) hypesthesia of the left half of the face; (*d*) incomplete paralysis of the facial nerve, with spasm; (*e*) total paralysis of the auditory nerve, and (*f*) paralysis of the last four cranial nerves.

Examination of the labyrinths showed that in the left ear there was total air deafness. There was vestibular nonirritability, 100 cc. of water at 180 C. provoking neither vertigo nor nystagmus. The right ear showed normal hearing.

Cold Caloric Test in Right Ear: Ten cubic centimeters of water at 27 C. applied with the patient in Bruning's position no. 1 (lying down) provoked violent vertigo and a horizontal nystagmus lasting three minutes; 30 cc. of water at 25 C. applied with the patient in position no. 3 (upright) provoked neither vertigo nor nystagmus, but if the patient was replaced in position no. 1, nystagmus and vertigo made their appearance in less than ten seconds.

Rotatory Test: Five rotations toward the left in ten seconds, with the head inclined laterally, caused a few jerks of vertical nystagmus, with slight vertigo. Five rotations toward the left in ten seconds, with the head inclined backward, provoked slight vertigo without evident nystagmus.

Comment by Collet and Mayoux on the Various Interpretations of Eagleton's Syndrome.—French surgeons have generally refused to admit that an elective functional disturbance of the vertical canals actually occurs. Hautant has considered it a sign of vestibular hypoirritability, which first appears in the vertical canals because they are physiologically less irritable than the horizontal canals and are in a "bad position for examination" (Bruning's position no. 2).

G. A. Weill has regarded Eagleton's syndrome as an ordinary phenomenon of vestibular compensation, his explanation being that in the case of a unilateral labyrinthine lesion the opposite labyrinth becomes hypoirritable, and the least apparent reflexes, namely, those of the vertical canals, are the first to disappear.

Collet and Mayoux expressed the belief that possibly this is true in some cases, but they stated that in their case Weill's interpretation does not explain the facts. The right labyrinth was not hypoirritable as a whole. With the patient in position no. 1 (lying down) the horizontal nystagmus was obtained after ten seconds with 20 cc. of water applied at 27 C., at the same time as a violent vertigo. The right horizontal canal was accordingly hyperirritable.

Aubry and Caussé (1932) observed that the vertical nystagmus provoked by rotation is never abolished and that neither the Romberg sign nor the pointing test is modified. They expressed the belief that "hypoirritability of the vertical canals" is not present but only a loss of the induced nystagmus of rotatory type occurs from what they call "a pseudoparalysis of the vertical canals." Again, this interpreta-

tion is not satisfactory to Collet and Mayoux. With their patient in position no. 3 (upright) it was not only impossible to obtain a rotatory nystagmus, but there was neither vertigo nor deviation of the arms, nor was there inclination of the body.

They have expressed the opinion that the "expression of elective abolition of the provoked nystagmus of rotatory type" should be restricted to the phenomenon described by me. The labyrinth is actually nonirritable or hypoirritable in positions nos. 2 and 3, and for the present the reactions in these positions must be considered the same as those observed after destruction by operation of the vertical canals. They felt obliged to admit the reality of an "elective functional involvement of the vertical canals."

Localizing Value of Vertigo Produced by Lesions of the Central Vestibular Systems in the Brain Stem

Leidler [64] defined the basic symptoms of vertigo as (1) a sensation of turning or of traction of the entire body, at least of the head around the spatial axes, or as (2) a sensation of progression of the body as a whole in the direction of the spatial axes. He states that unless this "turning" or "progression sensation" is present a diagnosis of true cerebral vertigo is unwarranted, although there may be "associated manifestations," such as disturbances of equilibrium from irritative symptoms of the vegetative nervous system, et cetera.

Vertigo in Cases of General Increased Intracranial Pressure.—Vertigo is a frequent accompaniment of cerebral diseases. It is usually included in the category of general symptoms of pressure on the brain.

Anatomic Types of Cerebral Vertigo from Lesions of the Brain Stem.—Leidler drew the following conclusions from the literature: 1. Central, or "cerebral," vertigo accompanies lesions of the vestibular system from its caudal to its cephalic end. 2. The "fiber portion" of the cerebral vestibular system must be involved. He described the "fiber portions of the vestibular system," as (*a*) the descending vestibular root fibers which pass through the medulla to the cord (viz., Löwenthal's vestibular spinal tract [the large Deiters'-spinal tract establishing connections between Deiters' nucleus and the central gray column of the cord]); (*b*) the internal arcuate fibers; (*c*) the posterior longitudinal bundles, and (*d*) the root fibers of the vestibular nerves themselves.

He made statements which, if substantiated, are of great clinical importance: 1. Lesions of the nuclei alone do not produce vertigo. 2. Vertigo is most intense and persistent when the fiber systems of the

64. Leidler, R.: The Localization of Vertigo in the Brain-Stem, Confinia neurol. **1**:367-406, 1938; abstracted, Neuro-Psychiatric Institute of the Hartford Retreat, ser. 7, no. 45.

vestibular cerebral tracts of only one side are affected. 3. The vertigo is weak if only the posterior longitudinal bundles are affected. 4. A surrounding lesion which affects other systems but not the fiber portion of the vestibular system produces vertigo of short duration, and this only when the pathologic process is in close proximity to the vestibular fiber system and only at the beginning of the disease. (The vestibular system is represented in the pons by the posterior longitudinal bundles.) 5. (*a*) Vertigo does not occur if one posterior longitudinal bundle is injured in its most lateral part. (*b*) Vertigo occurs if both posterior longitudinal bundles are affected, but (*c*) it does not occur when the capacity for conduction of impulses has been entirely abolished. (*d*) Transient vertigo accompanies lesions situated in the base of the pons if both pyramidal tracts are severely damaged or destroyed at the level of the posterior corpora quadrigemina. 6. Pathologic processes that injure or destroy the region belonging to the vestibular system in the anterior corpora quadrigemina, (*a*) the posterior longitudinal bundles, (*b*) the posterior commissure, (*c*) the interstitial nucleus of Cajal and (*d*) the nuclei of Darkshevich do not produce vertigo.

Comment by Reviewer: The interstitial nucleus of Cajal is a collection of cells situated mesial to the cephalic extremity of the red nucleus; the descending fibers of the fasciculus longitudinalis posterior are largely derived from it (Tilney and Riley). Darkshevich's nucleus is defined as "a mass of cells in the upper part of the aqueduct above the third ventricle and extending into the walls of the ventricle; each is connected with the posterior commissure and posterior longitudinal bundle." Their functions are not as yet understood (Tilney and Riley).—W. P. E.

7. Morbid processes affecting the fourth ventricle or the cerebellum do not produce vertigo unless the fibers of the vestibular system are involved at any of the sites mentioned as producing vertigo.

Comment by Reviewer: To my mind the fact that pathologic processes in the region of the anterior quadrigemina in themselves never produced vertigo is one of the most significant findings in Leidler's survey.—W. P. E.

OTOGENOUS NONSUPPURATIVE ENCEPHALITIS

Forms of Nonsuppurative Intracranial Complications from Otitis Media

Encephalitis.—McConnell [65] emphasized that there are two types of nonsuppurative intracranial complications which are the result of otitis media. One is a "nonpurulent encephalitis," with symptoms similar to those of cerebral abscess. However, at operation no abscess is found. Its possibility should be recognized and unnecessary exploration avoided.

With the other type of nonsuppurative lesion there is no derangement of the cerebrospinal fluid. The fluid is clear and without increase in protein or cells.

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65. McConnell, A. A.: Nonsuppurative Intracranial Complications of Otitis, Brit. M. J. **2**:659-660 (Oct. 2) 1937.

Two Varieties of Otitic Hydrocephalitis.—There may be (*a*) nonsuppurative "otitic hydrocephalus" from an increase in the amount of the fluid; this form causes signs of increased intracranial pressure without localizing symptoms. Or there may be (*b*) an interference with the circulation of the cerebrospinal fluid, from which an internal hydrocephalus at the outlet of the ventricles results. In both varieties the symptoms are those of increased intracranial pressure, namely, intermittent headache and usually papilledema.

Papilledema, however, is more common with the first variety of hydrocephalus. For this variety lumbar puncture is curative; for the second variety, with localized obstruction, lumbar puncture is not curative and may not be safe.

According to McConnell's experience, a definite clinical diagnosis cannot be made between a general excess and a localized collection of cerebrospinal fluid. He suggested that ventricular puncture be done first; if a communicating hydrocephalus is present, lumbar puncture may then be used for treatment.

Otogenous Nonsuppurative Encephalitis from Labyrinthitis.—Jerlang [66] reported the case of a patient with cerebral symptoms from suppurative otitis media on the right side, associated with signs of serous labyrinthitis. The symptoms were typical of cerebral abscess; cerebral and cerebellar punctures were performed and were repeated five weeks later. At no time was an abscess of the brain located. The symptoms completely disappeared in three months.

Jerlang stated that puncture of the brain must not have an unfavorable effect on the encephalitis; this because recovery is the rule.

Comment by Reviewer: Any one who has microscopically examined the cerebral tissue along the track of a diagnostic puncture must appreciate the falsity of such a statement. Any puncture is attended with some danger, especially in the presence of a suppurative process in the neighborhood.—W. P. E.

Jerlang, of Copenhagen, Denmark, collected from the literature 18 cases in which an abscess of the brain from suppurative otitis had possibly been formed and then had been absorbed or had become encysted.

He expressed the belief that otogenous encephalitis is a clinical entity, the inflammatory process stopping short of suppuration. Recognition of its existence is important, especially in those cases in which puncture of the brain fails to reveal pus.[67]

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66. Jerlang, E.: Otogenous Non-Purulent Encephalitis, J. Laryng. & Otol. **53**:283-292 (May) 1938.

67. Otogenous Non-Purulent Encephalitis, annotation, Lancet **1**:1286-1287 (June 4) 1938.

Symptoms of Otogenic Encephalitis.—Jerlang stated that with encephalitis the temperature is usually high and is often of the septic type; a subnormal temperature has never been recorded. The pulse rate is proportionate to the temperature, bradycardia never occurring. The fluid from lumbar puncture varies from normal to turbid, with numerous cells, with or without increase of pressure. Consequently, examination of the fluid in these respects is not helpful in the diagnosis.

In Jerlang's own case cerebral puncture was performed in five different directions and cerebellar puncture in three, without striking pus. This procedure was repeated after five weeks. The patient slowly made a complete recovery and has remained well for eighteen months.

SINUS THROMBOSIS WITH CEREBRAL SOFTENING

Extensive Cerebral Thrombosis with Softening of the Brain Originating in Bilateral Otitis

Irish[68] referred (case 32) to an infant with bilateral otitis media of four months' duration, with diarrhea and vomiting for nine days, associated with fever for four days, and recent cough, drowsy spells and elevated temperature. The infant died from respiratory failure on the seventh day after admission.

Retrograde Extension of Thrombotic Process.—Autopsy revealed thrombosis of the knee and of the horizontal portion of the right lateral sinus, where the infective thrombotic process had apparently started, as there was empyema into the sinus. A retrograde thrombophlebitis had extended into the superior longitudinal sinus, the straight sinus, the inferior longitudinal sinus and the venous system of Galen, as well as into the superior cerebral veins. The surface of the brain showed subarachnoid hemorrhage and flecks of thrombus. The infective thrombotic process had caused extensive softening from the nutritional death of the right parieto-occipital region, with an associated spot of softening in the right frontal lobe. The major portion of the cortex of the posterior part of the brain also showed softening, which extended into the ventricle.

Aphasia from Meningoencephalitis with Right-Sided Otitis

Circumscribed meningoencephalitis from sinus thrombosis on the same side with a suppurative ear or even on the side with a normal ear may give rise to symptoms such as are usually associated with abscess of the brain.

In a case of otogenic sinus thrombosis observed by Fervers,[69] aphasic disturbances appeared after antrotomy on the right side. The patient was right handed. After operative removal of a sinus thrombosis on the right side, which was present without fever and chills, the cerebral phenomena disappeared and the patient recovered. (The sudden subsidence after operative intervention is of importance for the differential diagnosis.)

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68. Irish, C. W.: Sinus Thrombosis: I. Lateral Sinus Thrombosis, Ann. Otol., Rhin. & Laryng. **47**:112-113 (March) 1938.

69. Fervers, T.: Die Bedeutung von Hirnerscheinungen für die Diagnose der otogenen Sinusthrombose, Thesis, Erlangen, 1937, p. 13.

CEREBROSPINAL FLUID

EFFECT OF LYOPHILE SERUM ON CONTINUED REDUCTION OF CEREBROSPINAL FLUID PRESSURE

Hughes, Mudd and Strecker [70] stated that "from theoretic considerations, the ideal hypertonic solution for reducing intracranial pressure is one that not only has a high osmotic pressure but contains 'solutes' which will remain in the blood vessels after injection." Such a solution "exerts a continued osmotic effect."

For the purpose of studying the relative effectiveness as a cerebral dehydrating agent of the two types of serum solutions—(*a*) serum prepared with water and (*b*) serum prepared with a solution of sucrose—contrasted with the effect of (*c*) a 50 per cent solution of sucrose, volunteer patients with normal spinal fluid pressure were selected.

The authors adopted the term lyophile for desiccated normal blood serum. "Lyophile" in chemistry is applied to colloidal systems in which the disperse phase is a liquid and has an attraction for the dispersion medium. The term lyophile is used by Reichel for desiccated normal blood serum, indicating its ready solubility.

Hughes and his associates found that, while use of concentrated serum dissolved in water is the better clinical procedure, human lyophile serum is highly effective in reducing increased intracranial pressure for relatively long periods and that a concentrated solution of doubly processed human lyophile serum has been used to reduce intracranial pressure. Blood pressure is increased after the injection of lyophile serum.

Human lyophile serum of four times normal concentration may be given by slow intravenous injection up to amounts of 200 cc. The ability to raise the blood pressure indicates that solutions of human lyophile serum should be useful in the treatment of circulatory failure due to shock or hemorrhage.

NORMAL LUMBAR CEREBROSPINAL FLUID PRESSURE AFFECTED BY POSTURE

Von Storch, Carmichael and Banks [71] tried to determine which of the elastic components of the craniovertebral system in man is responsible for the lumbar cerebrospinal fluid pressure when the subject is in the sitting position.

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70. Hughes, J.; Mudd, S., and Strecker, E.: Reduction of Increased Intracranial Pressure by Concentrated Solutions of Human Lyophile Serum, Arch. Neurol. & Psychiat. **39**:1277-1284 (June) 1938.

71. von Storch, J. C.; Carmichael, E. A., and Banks, T. E.: Factors Producing Lumbar Cerebrospinal Fluid Pressure in Man in the Erect Posture, Arch. Neurol. & Psychiat. **38**:1158-1175 (Dec.) 1937.

They concluded that the elastic elements of the craniovertebral system concerned with the erect posture are: (1) venous alteration, i. e., possible expansion of (*a*) intracranial veins and (*b*) intradural lumbar veins, and (2) dural alterations, i. e., (*a*) possible collapse of the cervical domain and (*b*) possible lumbar expansion. The authors concluded that the lumbar cerebrospinal fluid pressure in man when he is in the erect sitting position is a reflection of the intradural venous pressure existing at the point of measurement and that the normal lumbar cerebrospinal fluid pressure of the subject in the sitting position bears no relation to the normal pressure of the same person in the recumbent position. For the lumbar cerebrospinal fluid pressure in man in the sitting position is roughly equivalent to the vertical distance between the cisterna magna and the point of puncture. However, lumbar cerebrospinal fluid pressure with the head down averages 65 mm. of water more than the atmospheric pressure, according to E. Gaeme Robertson.

EFFECT OF STIMULATING THE CAROTID SINUS ON THE CEREBROSPINAL FLUID PRESSURE

Cohen's [72] experiments showed that mechanical excitation of the carotid sinus brings about an increase in the pressure of the cerebrospinal fluid. He expressed the belief that the sinocarotid test is of value in certain cases of spinal subarachnoid block. This is because stimulation of the carotid sinus in the presence of a block will not cause the increase in the pressure of the fluid that normally occurs.

ABSCESS OF THE BRAIN

GENERAL CONSIDERATIONS

"VENOUS COMMUNICATIONS" AS A CAUSE OF MULTIPLE ABSCESSES OF THE BRAIN

Krepuska [73] in 105 cases of abscess of the brain found multiple abscesses in 6 cases (5.7 per cent). Double abscesses occurred in the cerebellum in 3 cases, in the cerebrum in 2 and in both the cerebrum and the cerebellum in 1. In 1 instance there were multiple microscopic abscesses.

Krepuska expressed the belief that the multiplicity of abscess of the brain is referable to venous communications between the tentorium cerebelli and the petrous bone and between the petrous bone and the cerebellar substance. The prognosis is uniformly unfavorable.

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72. Cohen, E. I.: L'influence du sinus carotidien sur la tension rachidienne; le mécanisme d'action du "luminal," J. belge de neurol. et de psychiat. **37**:45-50 (Jan.) 1937; abstracted, Arch. Neurol. & Psychiat. **39**:1327 (June) 1938.

73. Krepuska, S.: Ueber die multiplen otogenen Hirnabcesse, Ztschr. f. Hals-, Nasen- u. Ohrenh. **40**:536-543, 1937.

Meurman [74] tabulated the otogenic abscesses of the brain observed at the Helsingfors Clinic from 1901 to July 1937.

Acute and Chronic Otitis as a Cause of Abscess of the Brain

There were 77 cases of otogenic abscesses of the brain. 1. Acute otitis caused nearly one sixth of the total. 2. Cerebellar abscesses from acute otitis furnished over one fourth of the total abscesses from acute otitis.

3. The abscesses originating from chronic otitis were distributed almost evenly between the cerebrum and the cerebellum, those originating in the latter being slightly more common. 4. A double abscess of the cerebrum and the cerebellum occurred in only 2 patients (2.6 per cent). 5. Sinus thrombosis frequently gives rise to cerebellar abscess associated with circumscribed meningitis.

Cerebral Metastatic Abscess

Of the 40 otogenic abscesses in the cerebrum, of which 7 were multiple, only 1 was truly metastatic.

Multiple cerebellar abscesses (Meurman, table 3) were present in 6 of 35 cases (17 per cent). With the inclusion of 2 cases in which there was circumscribed purulent meningitis in the posterior cranial fossa as well as a cerebellar abscess, the percentage rose to nearly 23 per cent.

Favorable Results of Surgical Treatment of Multiple Abscesses

1. The prognosis for multiple abscesses of the brain is worse than for solitary abscesses. 2. That it is "entirely unfavorable," however, as was stated by Krepuska, is not confirmed by Meurman's data. Of 7 patients with multiple abscesses in the cerebrum, 4 recovered, and of the 6 with true multiple cerebellar abscesses, 2 recovered.

Technic.—Meurman's cases of cerebellar abscess show how important it is not simply to expose Troutman's triangle but to expose also a sufficiently large portion of the dura behind the sigmoid sinus.

After-Effects.—Many patients who recovered suffered no after-effect. However, others had isolated epileptic attacks, which were controlled by prolonged therapy with sodium phenobarbital.

Comment by Reviewer: At the Newark (N. J.) Eye and Ear Infirmary, the first stage of an "unlocking of the petrous pyramid" [75] is performed in all cases of

74. Meurman, Y.: Zur Klinik und Pathologie der otogenen und rhinogenen Hirnabszesse mit besonderer Berücksichtigung der multiplen Abszesse und der diagnostischen Ventrikulographie, Acta oto-laryng. **26**:451-464, 1938.

75. Eagleton, W. P.: (*a*) The Cerebrospinal Fluid as an Aid to Diagnosis and Treatment of Inflammatory Diseases, J. Laryng. & Otol. **44**:657 (Oct.); 721 (Nov.) 1929; (*b*) Unlocking of the Petrous Pyramid for Localized Bulbar (Pontile) Meningitis Secondary to Suppuration of the Petrous Apex: Report of Four Cases with Recovery in Three, Arch. Otolaryng. **13**:386-422 (March) 1931.

suspected cerebral complication from a suppurating ear. This wide exposure of all nonfunctioning bony structures surrounding the pyramid has disclosed unsuspected areas of suppuration in so many cases that the procedure is now uniformly practiced by all the surgeons at the infirmary. In 1 case the "stalk of an unsuspected temporosphenoidal lobe abscess" was disclosed, resulting in its evacuation at the same operation in which the diagnosed cerebellar abscess was evacuated. The patient recovered.—W. P. E.

Sudden Death from Encephalitis, the Remains of a Cerebral Abscess

Meurman also reported a case of respiratory paralysis relieved, during artificial respiration, by evacuation of 25 cc. of pus from an abscess which had previously been located. However, the patient died suddenly two weeks later, while apparently doing well. Postmortem examination showed "a large dark-colored area in the hemisphere" without any pus, but the brain substance had not regained its healthy appearance.

"Contralateral Metastatic Subleptomeningeal Space Abscess" Complicating Suppuration of the Middle Ear of Scarlatinal Origin

Urbantschitsch [76] reported the case of a child aged 4½ years who was admitted to the hospital ten weeks after the onset of scarlatina and one month after the beginning of mild suppurative otitis media with mastoiditis. The good condition of the patient and the absence of marked pyrexia and of local symptoms referable to the ear were not consonant with meningitis of otitic origin. Convulsions occurred forty-eight hours after operation, followed by death. Cultures of material from the mastoid abscess and the cerebrospinal fluid both gave a pure growth of Streptococcus haemolyticus.

Postmortem examination revealed the presence of two small collections of pus in the subleptomeningeal space, both on the contralateral side; one was situated over the cerebellum and the other over the anterior pole of the temporal lobe.

Perforating Gastric Ulcer Secondary to Abscess of the Brain

A case of acute perforating gastric ulcer associated with an abscess of the brain of otitic origin was reported by Baron.[77] He expressed the belief that the perforated gastric ulcer had been caused by the abscess of the brain, as clinical experience and experimental evidence support the theory that peptic ulcer in certain instances is neurogenic.

The mechanism of the production of ulcer is probably a "parasympathetic-sympathetic imbalance," either through stimulation of the parasympathetic center in the interbrain or through paralysis of the sympathetic center from a lesion of the brain.

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76. Urbantschitsch, E.: Otogen-metastatische eitrige Meningitis, Wien. klin. Wchnschr. **51**:1053-1054 (Sept. 23) 1938; abstracted, J. Laryng. & Otol. **44**:230 (April) 1939.

77. Baron, S. H.: Perforated Peptic Ulcer from an Abscess of the Brain of Otitic Origin, Arch. Otolaryng. **29**:923-926 (June) 1939.

A 26 year old woman was admitted to the hospital complaining of pain in and around the left ear and a foul-smelling discharge from the canal, of long standing (twelve years).

Four days before her arrival she had a recurrence of pain in the ear, with which were associated some temporal and occipital headache on the left side and attacks of vomiting.

Physical examination disclosed absence of hearing by air conduction in the left ear and an inactive left labyrinth as shown by the caloric test. The neck was not rigid.

An immediate radical mastoidectomy was done on the left side. A culture of material from the middle ear contained Bacillus mucosus capsulatus.

On the sixth postoperative day the patient complained of headache on the left side; there was some depression of the knee jerks.

Two days later the temperature rose to 100.6 F. The neck was slightly rigid. Bilateral Kernig signs were suggested. A lumbar puncture revealed fluid under no increased pressure. The cell count was 66, all lymphocytes.

On the tenth postoperative day the excursions of temperature became more marked.

Two specimens of blood taken for culture were reported sterile. The general condition of the patient seemed good. The pulse was strong and of good quality. The patient had no particular complaints except a feeling of mild discomfort in the left side of the head. She experienced no nausea or vomiting and complained of no abdominal pain.

Sudden death followed.

Postmortem Examination.—When the cranial cavity was opened there was a large abscess involving the left occipital and temporal lobes of the cerebral cortex. This suppurative process had reached the left lateral ventricle and had invaded the ependyma, the caudate nucleus and the optic thalamus. The left lateral sinus appeared thrombosed.

A culture of material from the abscess of the brain showed gram-positive diplococci, large capsulated bacilli and hemolytic staphylococci.

On the lesser curvature in the distal third of the stomach, on the posterior surface, there was a perforated gastric ulcer.

Summary:—In this case there were abscess of the brain, thrombosed lateral sinus, mastoiditis, perforated gastric ulcer, septic spleen and acute glomerular nephritis.

Microscopic Observations.—Brain: In the subarachnoid space were seen two layers of inflammatory products, a peripheral zone of pus and exudate and, deeper, an equally distinct layer of plasm cells, lymphocytes histiocytes, fibroblasts and capillaries. A number of perivascular spaces of His in the cerebral cortex were gorged with the purulent exudate, which not infrequently was seen to have ruptured the pia mater and invaded the surrounding brain tissue, and a smaller number of spaces of His were gorged with plasma cells, lymphocytes and histiocytes.

The wall of the macroscopic abscess was seen to consist of masses of pus cells, exudate and necrotic brain tissue, throughout which were masses of staphylococci. The brain tissue showed necrosis, edema and congestion.

Gastric Ulcer: A section of the periphery of the perforated gastric ulcer showed the mucous glands disintegrating, with necrosis of the fragments. A moderate number of lymphocytes, plasma cells, histiocytes and rare polymorphonuclears were seen.

Kidney: A number of the glomeruli of the kidney showed the capillary loops gorged with blood, without proliferation of the endothelium or epithelium, and subcapsular hemorrhage; others showed marked proliferation of the endothelium and epithelium, a few polymorphonuclears and diminution of the blood within the capillary loops. The tubules showed intense degeneration, varying from cloudy swelling to necrosis.

Diagnosis.—The diagnoses were: acute or subacute leptomeningitis and acute suppurative encephalitis with abscess formation, acute peptic ulcer, which had perforated and apparently was neurogenic; glomerulonephritis in the first stage, and early suppurative perinephritis.

ABSCESS OF THE FRONTAL LOBE

Abscess of the Frontal Lobe as a Complication of Suppurative Otitis

Nielsen and Courville [78] give a summary of 34 cases of abscess of the frontal lobe of otitic origin. They also reported 5 cases of abscess of the frontal lobe of nasal origin, all fatal, the route of infection being most frequently by way of the anastomotic cerebral veins.

Latent Period Followed by Convulsive Symptoms.—In cases of abscess of the frontal lobe there is more apt to be a latent interval without symptoms than in cases of otogenous abscess of the brain in other locations. Convulsive symptoms, especially convulsions of the jacksonian type, occur more frequently. Mental symptoms are common.

Influenza as a Cause of Abscess of the Frontal Lobe

In Gurkow's [79] 4 cases of abscess of the frontal lobe of rhinogenic origin following influenza the infection spread by way of the vessels and the perivascular spaces, not by continuity. He stated (1) that youth is a predisposing factor in causing rhinogenic abscess of the frontal lobe and (2) that the prognosis is better than that of otogenic abscess of the brain.

Abscess of the Frontal Lobe Secondary to Empyema of the Sphenoid Sinus

Kaplan [80] reported a case of abscess of the frontal lobe secondary to empyema of the sphenoid sinus, in which the abscess was located by ventriculographic methods. Drainage resulted in recovery. He found but 6 other cases of this type in the literature, all of which were fatal.

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78. Nielsen, J. M., and Courville, C. B.: Otogenous Abscess of the Frontal Lobe: Review of Literature and Report of Five Cases, Acta oto-laryng., 1937, supp. 21, pp. 1-72.

79. Gurkow, A. D.: Frontal Lobe Abscess of Rhinologic Origin, Vestnik otol. **2**:191, 1937; abstracted, Zentralbl. f. d. ges. Neurol. u. Psychiat. **88**:347, 1938.

80. Kaplan, A.: Recovery from Abscess of the Frontal Lobe Secondary to Empyema of the Sphenoid Sinus, Arch. Otolaryng. **25**:66-72 (Jan.) 1937.

Abscess of the Frontal Lobe with Bilateral Cavernous Sinus Thrombosis from Suppuration of the Sphenoid Sinus

Poirier and Smith [81] reported the case of a man aged 42 who ten days prior to admission to the hospital had "a grippy infection," which two days before admission became localized in the right frontal region. The day before admission complete ptosis with restriction of motion of the right eye in all directions and a little exophthalmos appeared. On admission he had agonizing headache. The cerebrospinal fluid was normal. Roentgen examination revealed no abnormality except very bad teeth. On the fourth day after admission the right eye improved, but he now had complete ptosis of the left eye with inflammation and tenderness of the lids.

One week after entry he had beginning papilledema, slightly less than 1 diopter, of both nerve heads, more of the left. He showed slight stiffness of the neck and a slight Kernig sign.

Ten days after entry he had a severe chill, followed by paresis of the left side, during which he had a generalized convulsion. Lumbar puncture at this time showed the fluid under a pressure of 45 mm. It contained 13 cells. There were a slight rise in the colloidal gold reaction and an increase in sugar.

The diagnosis was bilateral thrombosis of the cavernous sinus.

On the following day, lumbar puncture showed 350 mm. of pressure; the cell count was still low (15); sugar was present. The patient had an average of three or four generalized convulsions each day for the two remaining days that he lived.

At autopsy both sinuses were full of pus, with rupture through the roof of the sphenoid sinus, so that pus surrounded the sella turcica. An abscess the size of a hand occupied the right frontal lobe of the brain. There were a retrobulbar abscess in the left orbit and an abscess in each cavernous sinus.

Comment by Reviewer: This case illustrates certain surgical points to which attention should always be directed in every suspected case of thrombophlebitis of the cavernous sinus of mesial (sphenoid) or anterior (ophthalmic) origin.[82] Meningitis is absent until the infective process retrogrades outward through the anterior cerebral veins and those of the cerebral cortex, before which time "drainage" and the "placing at rest" of the cavernous sinus may cure the patient. However, after basal meningitis has occurred all surgical intervention is fruitless. 2. Suppuration of the sphenoid sinus is frequently the origin of phlebitis of the cavernous sinus, although other foci, e.g., in the teeth, may be present. 3. An orbital abscess from rupture of thrombosed ophthalmic veins is a frequent complication. It should not obscure the diagnosis of involvement of the cavernous sinus. —W. P. E.

ABSCESS OF THE TEMPORAL LOBE

Roentgen Diagnosis of "Diverticula" and Rupture by Opaque Substance

Laskiewicz [83] reported a roentgenographic study of 10 cases of abscess of the temporal lobe of otitic or nasal origin. He employed a small

81. Poirier, G. H., and Smith, H. D.: Thrombosis of the Cavernous Sinus with Abscess of the Brain, Arch. Otolaryng. **27**:497-498 (April) 1938.

82. Eagleton, W. P.: Cavernous Sinus Thrombophlebitis, New York, The Macmillan Company, 1926.

83. Laskiewicz, A.: La lipiodographie des abcès cérébraux d'origine otique et nasale (d'après les observations de la clinique oto-laryngologique de l'université de Poznan), Rev. de laryng. **59**:217-253 (March) 1938.

quantity (2 to 3 cc.) of iodized oil—sesame seed (40 per cent iodine) or poppyseed (40 per cent iodine)—injected through a fine needle. The abscess appeared as an oval shadow. In 6 of the author's cases there were "diverticula" extending from the body of the abscess toward the lateral ventricle. In 3 cases there was a definite fistulous tract. Such a tract, he stated, can extend either toward the periphery or toward the ventricle. He asserted that injection of the iodized oil has no unfavorable effect and may even diminish the virulence of the infecting micro-organisms, presumably through the action of the iodine.—W. P. E.

Ventriculographic Methods for Diagnosis of Abscess of the Temporal Lobe

The otologic staff of the Children's Hospital [84] in Buenos Aires, Argentina, reported a case of recovery of a boy aged 12 years with an abscess of the right temporal lobe due to otitis media. The most important diagnostic aid was ventriculographic examination.

Rupture of Abscess into Ventricle Revealed Roentgenographically

A 9 year old girl had an abscess of the temporal lobe as a sequel of cholesteatomatous suppuration on the right side. "Contrast roentgenographic shadows" showed that the abscess had ruptured into the lower angle of the right lateral ventricle, with dilation of the ventricles. Death occurred eight days after the rupture.

Autopsy confirmed the roentgen findings of dilatation of the ventricles, as well as the presence of pus within them [85] ("pyocephalus internus").

PHLEGMONOUS ENCEPHALITIS

Course and Pathogenesis of Abscess of the Brain, Intracerebral Encephalitis and Phlegmon of the Brain

The pathogenesis of otogenic and rhinogenic intracerebral abscess, according to Brunner and Dinolt,[86] is as follows: The infection is carried along the veins (much more rarely, along the arteries) into the brain substance, where (1) circumscribed purulent encephalitis occurs. It is debatable whether there is at first (*a*) purulent encephalitis with secondary suppuration or (*b*) hemorrhagic encephalitis. Through extension and fusion of the encephalitic foci, (2) a pus-filled cavity is

84. Castilla, C. R., and Morea, R.: Abceso cerebral, Rev. méd. latino-am. **22**: 967-998 (June) 1937.

85. Cho, Shunhatsu: Pyocephalus internus infolge des Einbruchs des Schläfenlappenabszesses in den Seitenventrikel, insbesondere über dessen Röntgenbild sowie Obductionsbefund, Oto-rhino-laryng. **11**:101-102 (Feb.) 1938; abstracted, Zentralbl. f. Hals-, Nasen- u. Ohrenh. **30**:109, 1938.

86. Brunner, H., and Dinolt, R.: Ueber die otogene Encephalitis purulenta progressiva (Otogene Encephalitis phlegmonosa), Ztschr. f. d. ges. Neurol. u. Psychiat. **162**:106-125, 1938.

gradually formed, i. e., the abscess. This is followed by (3) a stage of latency. The abscess may or may not be encased in a capsule. Occasionally, (4) purulent progressive encephalitis originates from the pus-filled cavity. It is at this time that the abscess usually manifests itself. Later (5) the abscess ruptures either into the ventricle or into the arachnoid space but usually into the ventricle. There is thus induced (6) a terminal meningitis.

The initial stage of what Brunner called a "circumscribed encephalitis" may pass into (1) an abscess of the brain taking a chronic course, (2) an acute abscess of the brain, or (3) a phlegmon of the brain, which is relatively rare.

Phlegmonous Encephalitis Without Localized Abscess of the Brain

Brunner and Dinolt's [87] material consisted of 39 cases of cerebral abscess, which included 29 of otogenic abscess of the temporal lobe, 7 of traumatic abscess and 3 of metastatic frontal abscess. In 8 cases (32 per cent) the patients were cured; in 17 cases (68 per cent) the condition resulted in death. Four otogenic abscesses of the frontal lobe were not discovered before autopsy.

Brunner and Dinolt stated that in differentiation between acute abscess of the brain and phlegmonous encephalitis consideration should be given to these facts: (*a*) The course of encephalitis is much more violent. (*b*) The local symptoms of encephalitis appear almost apoplectiform. (*c*) Puncture of the brain gives negative results in the presence of encephalitis.

In 1 case of sinus thrombosis the patient had retrograde thrombosis into the occipital lobe. At postmortem examination there was no abscess, but the entire lobe was involved, there being a tendency for the encephalitic process to extend to the other side by way of the corpus callosum. Although there was no abscess microscopically, Brunner and Dinolt stated that thus a hemorrhagic purulent diffuse encephalitis existed, the rapidly progressive tendency of which justified its designation as "phlegmonous encephalitis," that is, a "rapidly progressive purulent encephalitis." Such a process may lead to ventricular infection without the formation of an abscess cavity.

In a second case, of acute exacerbation of chronic otitis on the right side, meningitic symptoms appeared two days after a radical operation. Incision of the dura was made seven days after the operation. Following the dural incision and a brain puncture, which gave negative results, there was a prolapse of the cerebral cortex, with two necrotic lesions. Death from meningitis occurred twenty-three days later. At postmortem examination no circumscribed abscess of the brain was found.

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87. Brunner, H., and Dinolt, R.: Zur Pathogenese und Pathologie des otogenen und rhinogenen Grosshirnabscesses, Monatschr. f. Ohrenh. **72**:255-276 (March) 1938.

DIAGNOSIS OF ABSCESS OF THE BRAIN

Unusual Symptoms of Otitic Abscess of the Temporal Lobe

Tobl [88] reported a case of abscess of the temporal lobe in which there was a latent stage of four weeks and which terminated in unconsciousness, associated with pendulum-like ocular movements. The ocular symptoms subsided twenty-four hours after opening of the abscess and withdrawal of 150 cc. of pus. The author expressed the belief that extensive cerebral edema played "a part in the causation of the ocular phenomena."

Differential Diagnosis

Differentiation of Abscess from (a) Arachnoiditis, (b) Tumor and (c) Acute Disseminated Encephalitis.—Henner [89] has discussed the differentiation of abscess of the brain from (1) acute disseminated encephalitis, (2) intracranial tumor and (3) arachnoiditis.

He emphasized the frequency of intracranial tumor and stated that even in the presence of an otogenic disease the possibility of a blastoma should be kept in mind, especially in the case of a child. Hypertension on the right is suggestive of tumor rather than of abscess.

In cases of encephalitis of the cerebellum the general symptoms are apt to be less marked than in cases of abscess, objective signs of pressure on the brain being lacking.

Arachnoiditis: Henner has observed 12 cases of intracranial arachnoiditis, all verified by operation. In 7 cases accumulation of fluid was localized in the posterior fossa; in 1, in the region of the optic chiasm, and in 4, at the convexity.

Arachnoiditis is apt to be unassociated with fever, and choked disk is usually absent. Thus, in a general way it may be said that with arachnoiditis (1) the syndrome of pressure on the brain is rarely pronounced and (2) the general condition is less affected than with abscess.

TREATMENT OF CEREBRAL ABSCESS

Surgical Importance of Complete Encapsulation in the Healing of Abscess of the Brain

Fremel [90] emphasized the surgical importance of the slight histologic differences between (*a*) a completely formed abscess capsule and (*b*) a simple pyogenic membrane. In 2 of his cases death occurred after

88. Tobl, P.: Surgical Therapy of Otogenic Brain Abscess, Orvosi hetil. **82**: 336-338 (April 9) 1938; abstracted, Zentralbl. f. Ohrenh. **30**:695, 1938.

89. Henner, K.: Diagnosis of Cerebral Abscess in Neurologic Practice, Časop. lék. česk. **77**:97-103 (Jan. 28) 1938; abstracted, Zentralbl. f. d. ges. Neurol. u. Psychiat. **90**:574, 1938.

90. Fremel, F.: Ueber Heilungsvorgänge otogener Hirnabszesse, Monatschr. f. Ohrenh. **71**:921-929 (Aug.) 1937.

the abscess of the brain had been apparently cured. Histologic examination showed a gap in the connective tissue capsule, through which the septic process advanced, or "exacerbated," in both cases.

He stated that recovery from abscess of the brain is dependent not entirely on the surgical measures employed but rather on the presence or absence of a series of processes beyond surgical control: viz., (1) the kind of pathogenic processes present and (2) the development of perfect encapsulation of the abscess.

Roentgen Irradiation in the After-Treatment of Abscess of the Brain

In the Vienna Clinic 3 patients with abscess of the frontal lobe and 1 with cerebellar abscess were treated by roentgen rays in addition to gauze packs.[91] In all 4 patients the course of the disease became smooth after the irradiation and ended in recovery, although previously an unfavorable outcome had been expected. Violent reactions occurred in patients with suspected encephalitic foci.

Technic.—Two to four roentgen ray irradiations were applied at intervals of from two to seven days. A dose of 20 to 100 r per treatment, filtered through 0.5 mm. of copper or zinc from a distance of 30 to 40 cm., was employed.

Enucleation of Abscess of the Brain

As a new treatment for subacute and chronic abscesses of the cerebral hemispheres, Vincent[92] recommended (*a*) extensive decompression and (*b*) enucleation, without drainage. He made no reference to abscesses of otogenic or rhinogenic origin.

Comment by Reviewer: Many years ago Ballance reported the enucleation of a fully encapsulated chronic abscess—which was handled freely without rupture—the diagnosis even at the time of enucleation being tumor of the brain. Similar experiences have occurred to all surgeons. There have been good results in these cases. But to suggest such a procedure for a subacute abscess is to disregard the pathologic fact that the infection in abscess of the brain is not entirely localized until it is surrounded by a firm zone of mesodermal tissue, which in the brain forms very slowly or may never occur. I observed a case of recurrence of an abscess that caused fatal meningitis four years after its apparent cure.[93]—W. P. E.

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91. Heindl, A.: Nachbehandlung von Hirnabszessen mit Roentgenstrahlen, Monatschr. f. Ohrenh. **72**:565-579 (June) 1938.

92. Vincent, C.: Eine neue Behandlungsmethode bei subakuten und chronischen Abszessen der Grosshirnhemisphären, Deutsche med. Wchnschr. **63**:1509-1513 (Oct. 1) 1937.

93. Eagleton, W. P.: Brain Abscess from the Standpoint of the Otolaryngologist, Tr. Am. Acad. Ophth. **34**:64-86, 1929.

Successful Drainage of an Abscess of the Brain in a Patient with Heart Block and Syphilis; Value of Dilated Pupil on Homolateral Side in Diagnosis of Abscess

Braunstein [94] cited the case of a woman aged 23 who complained of a generalized headache and a discharging left ear.

She had had trouble with the left ear at the age of 15 years and also three months prior to her admission to the hospital. She had vomited twice during the week prior to admission and on admission was stuporous.

Examination revealed a questionable right lower facial weakness. The tongue deviated to the right. Weakness of the right hand and a questionable adiadokokinesis were present. The abdominal reflexes were absent; the knee jerk was diminished on the right side. Slight nystagmus was present on looking to the right and to the left. There was beginning papilledema of the right nerve head. Pyorrhea alveolaris was evident. The nasal cavities contained free pus. The left ear was discharging and showed otitis externa. Lumbar puncture liberated clear spinal fluid under marked pressure, with a cell count of 18 lymphocytes.

A roentgenogram showed cloudiness of the right frontal sinus. The right mastoid was sclerotic.

Electrocardiograms.—An electrocardiogram showed an auricular rate of 50 and a ventricular rate of 30. In all four leads there was a complete dissociation of the auricle from the ventricle.

Advancing Cerebral Symptoms.—Two days later the left pupil was dilated and the right appeared contracted. Choked disk was present bilaterally, greater on the left side. There were marked stupor and apathy.

The temperature was 99.6 F.; the pulse rate, 28.

The spinal fluid was under pressure and contained 50 cells. The reaction for globulin was 3 plus. The Kline test gave a positive reaction. The value for sugar was 74.1 mg. per hundred cubic centimeters. The Wassermann reaction was 4 plus. A culture was negative.

Diagnosis.—The diagnoses were: chronic purulent otitis media on the left side; abscess in the left temporosphenoid region; complete heart block, and severe myocardial damage.

Drainage of Staphylococcic Abscess of Brain.—An abscess of the left temporosphenoid lobe was drained. Culture of pus from the abscess grew nonhemolytic staphylococci and Staphylococcus aureus. A direct smear showed gram-positive cocci in short chains.

The patient recovered.

Braunstein made the following comment on the value of a dilated pupil on the homolateral side in the diagnosis of abscess of the temporosphenoid lobe:

In Jackson Coates's treatise (1929) the following statement by Eagleton appears under "Non-localizing Paralysis": "An inequality of the pupils is of little localizing value. It is evidence of cerebral involvement, but a contracted pupil of the homolateral side from irritation may be of assistance."

However, Braunstein's experience has been that a dilated pupil on the side of the involved ear is of significance and is an important sign of cerebral pressure in an abscess of the temporosphenoid lobe. The pupil

94. Braunstein, J. E.: Brain Abscess, Heart Block, Syphilis, Am. J. Surg. **35**:609-612 (March) 1937.

is supplied by the third nerve, and when this nerve is involved by pressure only the sphincter fibers are affected, giving a unilateral mydriasis. Because of the pressure paralysis of the sphincter muscle of contraction, the sympathetic nervous system dilates the pupil.

Otitic Abscess of Brain from Mixed Infection, with Positive Wassermann Reaction; Symptoms Apparently Relieved by Antisyphilitic Treatment

Arauz's [95] contribution from the Rawson Hospital in Buenos Aires, Argentina, is the case of a woman aged *27* with a history of suppuration of the left ear for five years.

Examination showed two perforations in Shrapnell's membrane. There was headache on the left side but no other cerebral symptoms. Radical operation revealed cholesteatoma. Cerebral fluid escaped from the dura over the tegmen tympani.

Ten days after operation severe headache, loss of consciousness and mild meningitic symptoms were present. The cerebral fluid contained *32* lymphocytes and gave a positive Wassermann reaction. Improvement occurred after antisyphilitic treatment, with disappearance of the cellular elements, followed later, however, by severe headache, vomiting, a positive Kernig sign, subfebrile temperature, paralysis of the third cranial nerve and Argyll Robertson pupil. The diagnosis was abscess of the brain. The pus from the abscess contained a mixed microbic flora.

Autopsy showed an abscess in the anterior third of the sphenoid lobe, extending as far as the occipital lobe and opening into the lateral ventricle.

The authors expressed the belief that the abscess of the brain was present prior to the first operation and that an earlier diagnosis of abscess was not made because the symptoms were thought to be from lymphocytic meningitis due to the syphilis.

Comment by Reviewer: The importance of the transplanting of one infection onto another or the restraining influence of low grade infections on micro-organisms of higher virulence in suppuration within the meninges has never been properly stressed. The whole subject is reviewed in my forthcoming book on "Infections of the Cranial Bones in Relation to Suppuration of the Meninges."—W. P. E.

CEREBELLAR ABSCESS

Typical Cerebellar and Vestibular Symptoms of Localized Cerebellar Abscess

In the 3 cases of cerebellar abscess reported by Hybasek,[96] the abscess originated from acute or subacute otitis media, being located on the right cerebellar hemisphere in all.

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95. Arauz, S. L.; Mercandino, C. P., and Tieffenberg, D.: Rev. Asoc. méd. argent. **52**:126-128, 1938.

96. Hybasek, J.: Three Cases of Cerebellar Abscess in Acute Purulent Otitis Media, Časop. lék. česk. **76**:549-553 (May 7) 1937; abstracted, Zentralbl. f. d. ges. Neurol. u. Psychiat. **88**:348, 1938.

In all these cases there was horizontal rotatory nystagmus, preponderantly toward the affected side. In 1 case there was also a vertical nystagmus. Adiadokokineses, cerebellar ataxia and direction of falling independent of the position of the head were present in all. The corneal reflex was diminished or abolished, but the ocular fundi were normal, in all.

Multiple Routes of Infection in Cerebellar Abscess of Otitic Origin

Courville and Nielsen,[97] in their study of cerebellar abscesses in 15,000 autopsies, found that a large percentage are of otitic origin; of 22 cases, the abscesses in all but 1 came primarily from an aural suppuration.

Routes of Infection Into the Cerebellum.—In 7 cases the route of infection was by way of the petrous angle, which was possibly true in 2 other cases. The infection was secondary to lateral sinus phlebitis in 3 cases and possibly in 2 others. In 1 case there were both erosion in the angle of the petrous bone and thrombosis of the lateral sinus. Labyrinthitis was definitely responsible for the abscess in 1 case and probably in 2 others, as no other possible route of infection was demonstrated.

In the 1 case of infection secondary to leptomeningitis there were multiple small abscesses in the middle cerebellar peduncle. In cases of infection through Troutman's triangle there is apt to be an abscess of the subdural space.

The authors expressed the opinion that a combination of two or even more routes may be responsible for the spread of the infection to the cerebellum in many cases.

OPERATIVE TECHNIC FOR ABSCESS OF THE BRAIN

Operation on the Gasserian Ganglion with Electrocoagulation of the Middle Meningeal Artery, Causing Impaired Hearing in the Opposite Ear

Dederding and Jerlang [98] investigated the postoperative auditory and vestibular symptoms of patients who, having suffered from typical severe "trigeminus neuralgia," had been operated on by (*a*) section

97. Courville, C. B., and Nielsen, J. M.: The Pathogenesis of Otogenous Cerebellar Abscess, California & West. Med. **47**:29-36 (July) 1937.

98. Dederding, D., and Jerlang, E.: Acoustic and Vestibular Functional Disturbances After Temporal Retroganglionic Trigeminotomy, Acta psychiat. et neurol. **13**:219-226, 1938; abstracted, Neuro-Psychiatric Institute of the Hartford Retreat, ser. 7, no. 56.

of the sensory root with (*b*) electrocoagulation of the middle meningeal artery and (*c*) severance of the large and small superficial petrosal nerves to "prevent traction on the geniculate ganglia and facial paralysis."

Loss of Hearing After Operation.—The 28 patients fall into two groups: 1. Of the 20 examined by the authors both before and after operation, 19 had normal hearing and vestibular reactions before operation and 1 had slight deafness. Examination within six to eleven days after operation showed a reduction in hearing in all. In 10 of the 20 patients hearing on the side not operated on was also slightly impaired.

2. Of 8 patients whom the authors did not examine before operation but who reported having normal hearing, only 3 had normal hearing from two to thirty months after operation, while in the remaining 5 the hearing was reduced in various degrees at different times.

The majority of the patients improved without gaining their normal hearing in from two to fifteen months. However, some did not improve, and a few grew worse.

Eleven patients complained of buzzing; a few others complained of a sensation of pressure on the side operated on.

Vestibular Symptoms.—Spontaneous nystagmus was detected in 20 patients, and postrotatory nystagmus could be induced.

A Vasomotor Mechanism Connecting the Two Labyrinths.—Dederding and Jerlang expressed the belief that it is possible that electrocoagulation of the middle meningeal artery may have been a factor in the impairment of hearing by causing an edema in the middle ear and labyrinth, as they considered vascular edema the cause of the aural disease observed. They stated that it is reasonable to suppose that there are vasomotor connections which govern the vessels and the secretion between the middle ear and the labyrinth. The vasomotor impulses pass through the trigeminus nerve from one labyrinth to the opposite labyrinth. It is this mechanism which equalizes congestion in the two labyrinths. In this way, severe vestibular disturbances from a slight congestion in one labyrinth would be prevented.

Comment by Reviewer: Dederding and Jerlang's suggestion of the possibility of the existence of a "vasomotor regulatory mechanism" (although they do not give it that name) which connects both labyrinths by way of trigeminal "chiasmal fibers" has never been brought to my attention before. It is of great physiologic and clinical value, explaining many of the hitherto contradictory observations concerning nystagmus and vertigo with diminished contralateral hearing. The mechanism acts to prevent any slight vascular disturbance or slight exudate in one labyrinth from causing severe vestibular symptoms, although the edema or exudate may affect the hearing in one or even in both ears.—W. P. E.

OTOLOGIC AND RHINOLOGIC MANIFESTATIONS OF INTRACRANIAL TUMOR

Intracranial Tumor Involving the Greater Superficial Petrosal Nerve, with Otologic and Rhinologic Symptoms

A case of tumor of the greater superficial nerve was reported by Tremble and Penfield.[99]

A man, aged 42, in the latter part of 1929 had his attention called to the fact that the left side of his face was partially paralyzed. During the next year the paralysis progressed until it was complete.

Two years after the appearance of the facial weakness he began to hear a constant buzzing in his left ear, and his hearing gradually became less acute. He was admitted to the hospital on Jan. 28, 1935, complaining of "left facial paralysis" of five years' duration and of tinnitus and partial deafness of the left ear over a period of two and a half years.

Examination.—Facial Nerve: There was paralysis of the left side of the face, including the upper portion. There was slight contraction in the left frontalis muscle. There was occasional involuntary movement of the left angle of the mouth, indicating an attempted regeneration of the nerve.

Sensation of Taste.—Examination of the Chorda Tympani (Anterior Part of Tongue): Concentrated salt solution on the right side of the tongue was identified in five seconds; it was not identified after one minute on the left side. Vinegar was suggestively better recognized on the right than on the left side of the tongue, but the results varied. The posterior third of the tongue showed no difference in recognition of salt, vinegar or sugar between the right and the left side.

Salivary Secretion.—There was a marked diminuation in secretion from the left submaxillary and sublingual glands, due apparently to an interruption of fibers of the chorda tympani in their passage within the seventh nerve to the salivary glands.

The estimation of the salivary secretion, on the right, was: 0.61 Gm.; on the left, 0.17 Gm.

Examination of the Greater Superficial Nerve.—Lacrimal Secretions: There was a marked diminution of the lacrimal secretion on the left side as compared with the right (1:50). This was interpreted as evidence of involvement of the facial nerve (at, or proximal to, the geniculate ganglion) or of the greater superficial petrosal nerve.

Quantitative estimation of the lacrimal secretion was made by means of a tampon placed near the external canthus of each eye. The weight of the tampon before and after was determined. The secretion of tears was stimulated by means of ammonia, and the difference from the normal amount was measured. The right gland secreted 0.055 Gm. in two minutes, and the left gland, 0.001 Gm.

Examination of the Auditory Nerve.—A watch was heard at 12 inches (30.5 cm.) on the right side. It could not be heard on the left side. Air conduction was greater than bone conduction, but in the Weber test the sound was lateralized to the left.

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99. Tremble, G. E., and Penfield, W.: Operative Exposure of the Facial Canal, with Removal of a Tumor of the Greater Superficial Petrosal Nerve, Arch. Otolaryng. **23**:573-579 (May) 1936.

The audiogram showed a loss of 10 sensation units in each ear for conversational tones (i. e., tones of from 64 to 521 double vibrations). However, for the high notes (8,192 double vibrations) the hearing in both ears was affected, there being a loss of 35 sensation units in the left ear.

Examination of the Vestibular Nerve.—The caloric test showed a normal reaction to cold water on the right side and only a sluggish reaction on the left side. With the Bárány chair, ten turns to the right gave a moderate nystagmus to the left, with only slight dizziness. The same number of turns to the left gave an active nystagmus to the right, with marked dizziness.

Summary of Examinations.—The patient had partial paralysis of the left auditory nerve, with air conduction greater than bone conduction and the sound in the Weber test referred to the left. Vestibular responses were sluggish on the left side.

The left facial nerve was completely paralyzed except for a few fibers coming through to the left angle of the mouth. These were regenerated fibers, as was indicated by the fact that the angle of the mouth moved only involuntarily.

The left chorda tympani was paralyzed, as was indicated by decreased secretion of saliva from the sublingual and submaxillary glands on the left side and by loss of taste in the anterior two thirds of the tongue. But there was no impairment of the fibers for taste supplying the posterior third of the tongue or of those supplying the parotid gland, both of which are enervated by the ninth cranial nerve.

The greater superficial petrosal nerve, which leaves the facial nerve at the geniculate ganglion, was also paralyzed, as was indicated by the lack of increased secretion of tears on stimulation of the left conjunctiva. The site of interruption of the seventh nerve was thus obviously as far proximal as the geniculate ganglion.

Operation.—It was decided to expose the left facial nerve in its vertical and horizontal portions.

After identification of the horizontal semicircular canal the bone below as far as the stylomastoid foramen was taken away. The whole canal was uncovered, the facial nerve being exposed. Some of the bony floor of the middle fossa was removed. The facial nerve was identified at the bend and traced along its horizontal course. The stapes immediately below the nerve was found and carefully avoided.

At a point about 4 mm. from the bend, just above the oval window, the nerve was involved by a vascular mass of tissue. On removal of the roof of the middle ear a tumor herniated into the opening. It had extended through the bone from the facial canal to the subdural space, apparently following the canal of the greater superficial petrosal nerve. The tumor was curetted out and the seventh nerve left exposed. At no time was there any escape of cerebrospinal fluid. Complete removal would have involved removal of the dura in the presence of a contaminated field.

Pathologic Report.—The diagnosis was perineurial fibroblastoma.

Tremble and Penfield expressed the belief that no other description or case of perineurial fibroblastoma (neurinoma) arising in the vicinity of the geniculate ganglion of the greater superficial petrosal nerve has been recorded in the literature. Curiously enough, a tumor of this type, although common on the vestibular portion of the eighth nerve, is very

rare on any other cranial nerve. The fifth cranial nerve is the next most frequent site.

The authors urged that such an exploration should be carried out in many cases of paralysis of the facial nerve, with a view to (1) relief of the pressure on the facial nerve, (2) direct suture of the nerve or (3) facial hypoglossal anastomosis, as indicated by the operative findings.

SYMPTOMS OF VARIOUS INTRACRANIAL CONDITIONS

Hartmann and Guillaumat [100] stated: 1. Meningioma of the olfactory groove causes anosmia on one or both sides. It attains a large size before causing other disturbances, such as central facial paralysis or narrowing of the visual field and central scotoma due to unilateral compression of the optic nerve. 2. Meningioma of the lesser wing of the sphenoid bone is characterized by temporal and unilateral frontal pain, diplopia and unilateral exophthalmos. 3. Craniopharyngioma, or tumor of Rathke's pouch, is characterized by hypothalamic symptoms and by evidence of suprasellar calcification in the roentgenograms. 4. Infection of the sinuses may cause an opticochiasmal arachnoiditis, with atypical changes in the visual fields and absence of symptoms of intracranial hypertension and of roentgen changes in the sella turcica.

SURGICAL TECHNICS FOR VARIOUS CONDITIONS

DISFIGURING PROTRUSION OF THE TONGUE

Bilateral Peripheral Section of the Genioglossus Muscle

Ingebrigsten [101] reported the case of a man aged 20, who had had encephalitis at the age of 6 years, followed at the age of 14 by disfiguring protrusions of the tongue and severe hyperkinesis of the face.

At intervals of seconds or minutes the patient forcefully protruded his tongue and contracted both orbicularis oculi muscles and the masticator muscles supplied by the buccal division of the right facial nerve. He also frequently raised his clenched right hand to his mouth.

Ingebrigsten loosened the insertion of the genioglossus muscle where it is attached to the mental spine of the mandible on both sides. After a few days the involuntary protrusion of the tongue disappeared. The operation did not impair the chewing and swallowing movements, and the patient's speech greatly improved. The result had persisted for six months.

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100. Hartmann, E., and Guillaumat, L.: Symptômes oculaires des méningiomes suprasellaires, Ann. d'ocul. **174**:1-39 (Jan.) 1937; abstracted, Arch. Neurol. & Psychiat. **39**:1323 (June) 1938.

101. Ingebrigsten, B.: Surgical Treatment of Postencephalitic Involuntary Movements of the Tongue, Acta psychiat. et neurol. **12**:55-59, 1937; abstracted, Arch. Neurol. & Psychiat. **39**:1328-1329 (June) 1938.

FACIAL SPASM OF CEREBRAL ORIGIN

Paralyzing the Nerve by Injections of Alcohol.

Of 5 patients with facial spasm observed by Coleman,[102] 3 had clonic unilateral spasm and 2 bilateral spasm predominantly of the tonic type. The condition can be relieved by paralyzing the nerve by section or by injection of alcohol. With recovery from the paralysis the spasm usually returns, but the patient is grateful for relief.

FACIAL PARALYSIS

New Operation for Nerve Anastomosis for Facial Paralysis from Injury of Nerve Proximal to Geniculate Ganglion

There are several operations for restoring function to paralyzed facial muscles. The procedure that promises the best results in a given case should be instituted.

Poppen[103] stated that it is impractical to consider an end to end anastomosis in the case of a patient in whom a block dissection for the removal of a tumor of the parotid gland has resulted in paralysis of the facial nerve. The logical procedure is a muscle-nerve plastic operation, as described by Sheehan. Again, it is unwise to perform a muscle-nerve operation on a patient whose facial paralysis is due to division of the nerve in the facial canal during a radical mastoidectomy. In such a case an end to end nerve suture is the logical solution, or a nerve transplant if a portion of the nerve has been removed. Both operations must be distal to the geniculate ganglion. They are the only procedures that restore the normal physiologic impulses.

For, while both the spinal accessory and the hypoglossal nerve lend themselves to a satisfactory anastomosis with the facial nerve as it leaves the stylomastoid foramen, the functional result is imperfect, because the involuntary emotional facial movements never return. However, they can be closely simulated by practice, the patient developing what might be called habit movements of the facial muscles. And the vicarious movements of the face that at first occur whenever the shoulder or the tongue is moved after spinofacial or hypoglossal-facial anastomosis tend to diminish and usually disappear entirely.

Poppen suggested that operation be restricted to that type of paralysis (*a*) which will be permanent without surgical intervention and (*b*) in which the site of injury to the nerve is proximal to the geniculate

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102. Coleman, C. C.: Surgical Treatment of Facial Spasm, Ann. Surg. **105**: 647-657 (May) 1937.

103. Poppen, J. L.: Facial Paralysis Following Complete Extirpation of Acoustic Neuromas: Treatment and Results in Seventeen Patients, Lahey Clin. Bull., Boston, March 1939, pp. 8-14.

ganglion (as has occurred to me [W. P. E.] in drainage of the petrous apex).

Since surgical repair of the facial nerve is impossible when it is injured in its passage from its nucleus in the medulla to the geniculate ganglion, other intracranial nerves must be substituted. Poppen had 17 patients with facial paralysis after removal of the nerve proximal to the geniculate ganglion during extirpation of an acoustic neuroma. He performed anastomosis of the proximal end either of the spinal accessory or of the hypoglossal nerve to the distal end of the facial nerve trunk at the stylomastoid foramen.

Technic.—The technic of the operation is that described by Peet. An oblique incision extending about 1 cm. behind the ear, well above the tip of the mastoid, is carried downward along the anterior border of the sternocleidomastoid muscle to the level of the cricoid cartilage. The superficial cutaneous nerves are divided and the sternocleidomastoid muscle elevated with a retractor. As soon as the spinal accessory nerve has been identified, it can be gently picked up with a nerve hook and the trunk followed upward underneath the posterior belly of the digastric muscle. The dissection is carried upward, the sternocleidomastoid muscle being separated carefully from the parotid gland. The parotid gland is retracted anteriorly, and the medial portion of the attachment of the sternocleidomastoid muscle is removed from the tip of the mastoid. The posterior belly of the digastric muscle may then be freed and a tape placed around it for retraction. The facial nerve is found emerging from the stylomastoid foramen. If the nerve divides immediately on emerging from the foramen, the trunk is divided in the canal, which can be accomplished by removing the medial tip of the mastoid and unroofing the lower portion of the facial canal. The trunk is divided as far proximal as is possible, so that a longer stump is available for anastomosis. The spinal accessory nerve is now divided about 1 cm. medial to the sternocleidomastoid muscle. The proximal end is picked up by its sheath and brought under, through the posterior belly of the digastric muscle, and the distal end of the facial nerve is deflected downward without damage to it. A through and through suture is placed approximately 1 mm. above the cut surface of each nerve, and by loosely tying the silk the ends of the nerves are brought together. This allows the nerve sheaths to be approximated with two or three interrupted sutures superficially placed. The descending branch of the hypoglossal nerve is divided, and its proximal end is sutured to the distal end of the spinal accessory nerve to maintain tone in the muscles supplied by the nerve.

A similar technic is used in anastomosis of the hypoglossal and facial nerves. Whenever an accurate anastomosis has been performed, function of the facial muscles will appear in from three to twelve months.

MENINGITIS

UNUSUAL TYPES OF MENINGITIS FROM THE NOSE

Meningitis by Extension Along Both Olfactory Nerve Sheaths Following Removal of Polyps From Right Nostril

Brunner [104] reported a fatality from meningitis after removal of polyps from the right side of the nose.

It is noteworthy that histologic examination showed that the inflammation had passed into the meninges along the sheaths of the olfactory nerve of the left (the opposite) side, as well as along the right olfactory nerve sheath—that is, there was suppuration of both olfactory sheaths, although the operation for polyps had been performed on but one side.

Five days after the extraction of the polyps, the frontal sinus and the ethmoid and sphenoid sinuses on the right side were found to contain fetid pus and necrotic granulations. Slight transitory improvement followed, but pain in the occiput, especially on movement of the head, suggested suppurative meningitis. Furthermore, displacement of the left eye was suggestive of a localization of the inflammatory process to the left half of the skull. Death occurred seven days after the extraction of the polyps.

Site of Focus and Bacteriologic Cause of Rhinogenic Meningitis

Imperatori [105] stated that 17 cases of rhinogenic meningitis had been observed at the New York Post-Graduate Medical School and Hospital in the last ten years.

Of these, the condition in 7 complicated paranasal sinus disease; in 7 it followed intranasal operations on the sinuses; in 1 it followed thrombosis of the cavernous sinus due to a nasal furuncle, and in 1 it followed acute fulminating ethmoiditis without operative intervention (other than removal of necrotic bone after subsidence of the meningitis). The infecting organisms were the staphylococcus in 9 cases, the streptococcus in 5 and the pneumococcus in 2.

Imperatori expressed the opinion that septal operations should not be performed or polyps removed in the presence of acute infection.

Comment by Reviewer on Precipitation of Rhinogenic Meningitis by Operation: The very large proportion of cases of meningitis following intranasal operations (nearly 50 per cent of all the cases) is noteworthy. It is my experience that the meningitis is but a recrudescence of a former intrameningeal infection, as all the patients have a history of previous headache, and often of attacks of vomiting. Such symptoms should be a warning to the surgeon adequately to prepare the patient by vaccine therapy, sulfanilamide and so forth and to perform a lumbar puncture before subjecting him to any nasal operation in diseased tissue in proximity to the dura.[106]—W. P. E.

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104. Brunner, H.: Zur Pathologie und Klinik der rhinogenen Meningitis, Ztschr. f. d. ges. Neurol. u. Psychiat. **157**:92-99, 1937.

105. Imperatori, C. J.: Suppurative Meningitis Caused by Paranasal Sinus Disease, Laryngoscope **47**:306-310 (May) 1937.

106. Eagleton, W. P.: Meningitis from the Sphenoid, Tr. Am. Laryng., Rhin. & Otol. Soc. **38**:51-62, 1932.

UNUSUAL CASES OF OTITIC MENINGITIS

Pneumonia in Children with Otitis and Symptomless Mastoiditis as a Cause of Oral Intracranial Complications; Discovery at Autopsy

Among the aural complications following pneumonia in children Towson [107] reported the following intracranial states: 1. Septic sinus thrombosis associated with meningitis, cerebellar abscess and pulmonary abscess, followed by death. 2. Lateral sinus thrombosis with symptoms of meningitis, followed by death. (Although sinus thrombosis is given as the cause of death, there was no postmortem examination and there had been no exposure of the sinus.)

Of the 354 patients with pneumonia between the ages of 1 month and 10 years admitted to the Jefferson Hospital, Philadelphia, between 1930 and 1934, 118, or 33⅓ per cent, had aural complications. Of 116 patients with otitis media, 19 (16.4 per cent) had mastoiditis.

In 1930, in a study of 38 autopsies performed on children from 7 days to 9 years old who had either bronchopneumonia or lobar pneumonia, Helwig and Dixon [108] observed involvement of the middle ear or of the mastoid, or both, in every case. In some of these cases the pneumonia was primary, and in others it was secondary to diseases other than those of the middle ear or of the mastoid.

Causes of Death.—The mortality from pneumonia with otitis media was 27.9 per cent. Of the 18 patients on whom mastoidectomy was performed, 2 died—1 with meningitis and sinus thrombosis and the other with septic sinus thrombosis, meningitis, cerebellar abscess and pulmonary abscess.

Symptomless Mastoiditis Without Otitis Observed at Autopsy.—Of the 4 patients (3.3 per cent) who died of mastoiditis, there were 2 in whom postmortem examination revealed mastoiditis without otitis media.

Streptococcic Pneumonia.—In another group of patients with pneumonia, the streptococcus was the organism most commonly found.

Symptomless Streptococcic Mastoiditis.—Here again the postmortem examination showed disease of the mastoid even without evidence of involvement of the middle ear.

In the cases of streptococcic pneumonia with aural disease the mortality was 3.3 per cent; this figure includes 2 cases of mastoiditis detected at postmortem examination.

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107. Towson, C. E.: Aural Complications of Pnuemonia in Children, J. Pediat. **2**:77-87 (July) 1937.

108. Helwig, F. C., and Dixon, O. J.: Frequency of Mastoiditis in Infants, Arch. Otolaryng. **11**:169-177 (Feb.) 1930.

Epidemic of Malignant Influenzal Meningitis of Otitic Origin

While in the preceding years and during February 1937, influenzal otitis in patients at the Graz Clinic [109] usually took a benign course, its character suddenly changed in March. Simultaneously several patients with influenzal inflammation of the middle ear had meningitis within a few days. In the 5 cases reported only 1 patient recovered.

Contagiousness of Bacterium Haemophilicum Mucosum (Grekowitz) Meningitis with Multiple Foci in the Temporal Bone

Heindl [110] reported a case of bilateral otitis with meningitis in which Bacterium haemophilicum mucosum (Grekowitz)—which is an influenza-producing bacillus—was present. The twin sister of the patient had died from the same infection a month and a half previously.

Histologic examination of the petrous bones failed to indicate whether the otitis (*a*) had passed through the windows, causing labyrinthitis with secondary meningitis; (*b*) had occurred by way of the tegmen, or (*c*) had originated in the petrous edge, with a retrograde infection of the internal ear, as there was a focus in all three locations.

Epidemic Cerebrospinal Meningitis Following Operation on the Mastoid

In the case of a young adult, reported by Tawara,[111] meningeal symptoms appeared twelve days after an operation on the mastoid. Study of the cerebrospinal fluid revealed it to be whitish and under a pressure of 160 mm. The Pandy reaction was positive; the Nonne reaction, negative. There were 250 cells but no bacilli. A radical mastoidectomy was performed. Twenty days later Meningococcus intracellularis was present in both the cerebrospinal fluid and the blood. The cerebrospinal fluid was now yellowish and cloudy; the pressure was 500 mm.; the Nonne and Pandy tests gave strongly positive reactions. Despite serum therapy the patient died.

Ascending Spinal Meningitis from Metastatic Osteomyelitis of the Vertebrae

A boy aged 12 years, as reported by Koch,[112] had suffered for many years from chronic otitis media with the formation of cholesteatoma. Operation revealed an abscess reaching from the occipital squama to the orbital margin. Death occurred from "incipient" meningitis. Autopsy showed metastatic abscesses in the heart, kidneys, lungs and seventh to ninth thoracic vertebrae, which latter caused ascending meningitis of the spinal cord.

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109. Jeschek, J.: Ueber Komplikationen bei Grippe-Otitis, Monatschr. f. Ohrenh. **71**:1304-1308 (Nov.) 1937.

110. Heindl, A., Jr.: Ein Fall von otogener Meningitis. Bazillus Grekowitz bei Zwillingen, Monatschr. f. Ohrenh. **70**:1511-1518 (Dec.) 1936.

111. Tawara, A.: Meningitis cerebro-spinalis epidemica bei einem Ohrkranken, Oto-rhino-laryng. **11**:13-14 (Jan.) 1938; abstracted, Zentralbl. f. Ohrenh. **30**:524, 1938.

112. Koch, F. X.: Schwere Komplikationen bei Cholesteatomeiterung mit Epiduralabszessbildung, Monatschr. f. Ohrenh. **7**:1231-1233 (Oct.) 1937.

MENINGITIS INVOLVING THE LABYRINTH

Late Meningitis and Labyrinthitis Years After Radical Operation

Resch [113] reported cases in which labyrinthine inflammation supervened after a radical operation had been performed three, six, nine and twelve years previously.

In the last case, twelve years after a radical operation, cavernous sinus thrombosis and meningitis, with a fatal outcome, occurred because of diseased perilabyrinthine cells.

Perilabyrinthine Otitis Causing Both Meningitis and Labyrinthitis

Histologic examination of the petrous bone by Marx [114] demonstrated what was thought to be meningitis from the labyrinth. In reality the process originated from an isolated empyema in the perilabyrinthine cells, with rupture, the perilabyrinthine otitis having caused both the meningitis and the labyrinthitis. The infection was primarily an old otitic process.

MENINGITIS INVOLVING THE APEX

Delayed Meningitis from Unsuspected Apical Streptococcus Mucosus Infection

In a case cited by Tanaka,[115] a man aged 41 years had acute otitis media on the right side for one month, with acute mastoiditis. An operation disclosed diseased pneumatized mastoid cells, with an extradural abscess lateral to the sinus. Streptococcus mucosus was found in almost pure culture. After another month symptoms referable to the apex developed. Radical operation was followed by diffuse leptomeningitis and death on the third day.

Cysts of the Petrous Apex from Pneumococcus Mucosus Infection Causing Meningitis

In a case reported by Rollin,[116] suppuration of the middle ear was insidious; death followed from meningitis. Histologic examinations revealed that the labyrinthitis and subsequent meningitis had occurred through bony erosion, with formation of small cysts behind the labyrinth from Pneumococcus mucosus infection. There were aberrant cells in the presence of arrested pneumatization.

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113. Resch, W.: Spätkomplikationen nach früherer vollständiger und einfacher Aufmeisselung, Ztschr. f. Hals-, Nasen- u. Ohrenh. **41**:415-426, 1937.

114. Marx, H.: Ueber den Nachweis der Genese der Meningitis, Hals-, Nasen- u. Ohrenarzt (pt. 1) **28**:150-153 (May) 1937.

115. Tanaka, H., and Hayashi, T.: Erfahrungen von Mucusotitis; otogene Mucosusmeningitis, im Anschluss an Mastoiditis, Extradural Abszess und Pyramidenspitzenentzündung, Oto-rhino-laryng. **10**:1101 (Dec.) 1937; abstracted, Zentralbl. f. Hals-, Nasen- u. Ohrenh. **30**:316, 1937.

116. Rollin, H.: Ueber Labyrinth-und Meningeinfektion durch retrolabyrinthäre Mukozele, Hals-, Nasen- u. Ohrenarzt (pt. 1) **28**:129-137 (April) 1937.

UNUSUAL CONDITIONS AND SIGNS IN THE DIAGNOSIS OF MENINGITIS

Absence of Rigidity of the Neck

In a study of aural and nasal meningitis, Davis [117] found that in 5 of his 51 cases of aural meningitis rigidity or stiffness of the neck was absent (about 10 per cent), and in 12 of the 16 cases of nasal meningitis there was no rigidity (75 per cent).

Furthermore, his autopsy records show that, while rigidity was always present when the meningitis was basal and the cisterna interpeduncularis contained pus, it was sometimes absent with cortical meningitis.

Dr. C. P. Symonds also has observed that meningitis does occur without rigidity. Rigidity develops only when the meninges of the dorsal aspect of the medulla are inflamed.

Differentiation of Acute Inflammation of the Middle Ear Cleft from Chronic Otitis

Layton [118] also expressed the belief that the symptoms which arise from an acute invasion of the "previously unaffected middle ear cleft" must be kept distinct from those which complicate chronic otitis media.

Clinical Differentiation of Types of Streptococcic Otitis Causing Meningitis

Cawthorne [119] stated that streptococcic meningitis constitutes about 6 per cent of all the meningitides and about one third of all forms of meningitis exclusive of those due to the meningococcus and to the tubercle bacillus.

Meningitis following a primary acute infection of the cleft of the middle ear should be differentiated from that secondary to long-standing chronic suppuration, because in the latter group there is usually some associated lesion of the dura mater or of the cortex that requires surgical attention.

In cases of fulminating meningitis the disease passes unhindered through the preformed spaces in the temporal bone, where it infects the meninges before it attacks the bone.

Cawthorne expressed the belief that the primary focus should be let alone when the meninges have been infected by the vascular route and that immune mechanisms should be allowed to function.

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117. Davis, E. D. D.: Streptococcal Meningitis, Lancet **1**:516-517 (Feb. 26) 1938.

118. Layton, T. B.: Streptococcal Meningitis, Lancet **1**:578-579 (March 5) 1938.

119. Cawthorne, T.: Streptococcal Meningitis, Lancet **1**:579 (March 5) 1938; Streptococcal Meningitis: Sulphanilamide in Its Management, ibid. **1**:304 (Feb. 5) 1938.

Otitic Infection Passing into the Leptomeninges by Way of Cerebral Hernia of the Cranial Base Protruding into the Middle Ear

Kecht [120] described how an acute infection of the middle ear was transmitted to the leptomeninges by an unrecognized internal cerebral hernia in an elderly man. He warned that an internal cerebral hernia may be torn off during ablation of the tegmen tympani and the subarachnoid space be thus opened.

In several postmortem examinations, hernias of the brain were found penetrating the petrous bone. Such basal hernias occur only in persons of advanced age, the cause being a preceding pressure on the brain. They generally occur in the middle fossa but may be present below the superior petrosal sinus.

STAPHYLOCOCCIC SEPTICEMIC MENINGITIS

Meningitis from Staphylococcic Septicemia

Staphylococcic septicemia is the most deadly of all septicemias. Complications occur early in the course of the disease and exist more frequently than can be discovered clinically. Mendell [121] discussed a series of 35 cases. There were 6 recoveries, 29 fatalities and 16 postmortem examinations.

There were 2 patients with infection of the nasal sinuses. Meningitis was the cause of death in both cases. In 1 case the condition originated in a dental infection. In 14 the portal of entry was the skin.

Treatment.—1. Eradication of the Source of Infection: This is the most important single factor in recovery of the patient. No treatment can be successful without complete removal of the focus which is feeding and reinfecting the blood stream.

2. Sterilization of the Blood Stream: Repeated transfusions, preferably immunotransfusions, are of undisputed value.

3. Biologic Agents: Bacteriophage was employed in 12 cases, in 2 locally and in 2 subcutaneously. Four patients died. In 8 of the cases it was used intravenously, according to the technic of MacNeal and Frisbee, with unsuccessful results. Of the nonfatal cases, bacteriophage had no effect in 1, and in the other it was definitely shocking and harmful and produced no effect on the blood culture.

Staphylococcus antitoxin was used in 3 cases, with 2 recoveries, but these could not be credited to the antitoxin. It is doubtful that the offending strain is present in the stock antitoxin in any given case.

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120. Kecht, B.: Zur Bedeutung der Hirnhernien in der Otologie, Hals-, Nasen- u. Ohrenarzt (pt. 1) **27**:346-353, 1936.

121. Mendell, T. H.: Staphylococcic Septicemia; A Review of Thirty-Five Cases with Six Recoveries, Twenty-Nine Deaths and Sixteen Autopsies, Arch. Int. Med. **63**:1068-1083 (June) 1939.

Prognosis.—The following factors are found to bear on the prognosis: (*a*) The possibility of eradicating the primary focus of infection that is feeding the blood stream and (*b*) the possibility of combating extension of the infection into distant organs and removing metastatic foci influence the prognosis favorably. (*c*) The fact that the sthenic age, young adulthood, as in most diseases, is the most favorable age with respect to combating the disease. Most of the recoveries in this series occurred in this age group. (*d*) The fact that the less numerous are the colonies of staphylococci in the blood culture, the more favorable are the chances for recovery. (*e*) The fact that coexistence of other disease states, particularly diabetes mellitus, with staphylococcic septicemia offers a very poor outcome. (*f*) The fact that extension of the disease to the brain, meninges or heart likewise influences the prognosis unfavorably. The 7 patients with meningitis and the 4 with cardiac toxic changes all died.

FRACTURES OF THE SKULL AS A CAUSE OF MENINGITIS

Late Meningitis from Transverse Fracture of the Petrous Bone

At the Zurich Clinic, as reported by Fehr,[122] 20 of the 417 patients who were admitted (4.8 per cent) suffered from meningitis originating from fractures of the accessory sinuses and of the petrous bone. In a group of 5 cases of otogenic meningitis a transverse fracture of the petrous bone was discovered in 3 patients, with acute purulent otitis as the source of the infection. In 2 cases meningitis developed as a sequel of acute otitis six months and three years respectively after the accident, and the patients succumbed as a result of it.

Histopathologic Observations in Intracranial Complications from Otitis Precipitated by (1) Fracture of Skull, (2) Tuberculosis and (3) Sarcoma of Pharyngeal Vault [123]

The 3 cases to be mentioned should be studied by all interested in the histopathologic relation of infections of the ear and nose to the brain and meninges. They do not lend themselves to being abstracted.

The first patient described had multiple fractures at the base of the skull. Clinical signs of fracture of the temporal bone predominated. Death occurred from suppurative meningitis. Histologic examination showed the meningitis to be of both rhinogenic and otogenic origin.

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122. Fehr, A.: Zur Behandlung von Schädelbasisbrüchen bei Komplikationen von seiten der Nasennebenhöhlen und des Ohres, Helvet. med. acta **4**:637-641 (Nov.) 1937.

123. Richter, H.: Beiträge zur pathologischen Anatomie des Ohres, Hals-, Nasen- u. Ohrenarzt (pt. 1) **29**:43-57 (Feb.) 1938.

The second patient, a child of 2½ years, suffered from secondary tuberculosis of the middle ear as well as tuberculous basal meningitis; death was due to general infection.

The third patient had a sarcoma of Waldeyer's tonsillar ring, with cachexia. Acute inflammation of the middle ear occurred shortly before death.

CHEMISTRY OF SPINAL FLUID IN MENINGITIS

Quantitative Chemical Analysis of the Fluid

The hydrogen ion concentration of the cerebrospinal fluid should first be determined, as has been advised by Beaumont and Dodds.[124] This is usually about 7.45. In some infections the organisms are said to ferment the dextrose present, thus producing acid and lowering the p_H.

Normal figures given by various observers differ considerably. The following tabulation represents the general opinion

Alkali reserve 58 to 63..... McClendon [125]
p_H (fresh) 7.4.....Tashiro and Levinson [126]
p_H (on standing) 8.3.....Leopold and Bernhard [127]

Estimation of the Chlorides, Bicarbonates and Hydrogen Ion Concentration in Cases of Meningitis

In examination of the cerebrospinal fluid, Kopetzky [128] noted the following factors:

1. There are more chlorides in normal spinal fluid than in the blood plasma. In cases of meningitis this gradient tends to be eliminated, and the chloride content of the spinal fluid and that of the blood plasma are more nearly alike.

2. In the presence of meningitis there is a decrease in the bicarbonate content of the spinal fluid, it being as low as 33 per cent below that of the blood plasma.

3. The p_H of the spinal fluid in cases of meningitis is much lower than either that of the normal fluid or that of the normal blood, and it

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124. Beaumont, G. E., and Dodds, E. C.: Recent Advances in Medicine: Clinical, Laboratory, Therapeutic, ed. 9, Philadelphia, P. Blakiston's Son & Co., 1939.

125. McClendon, J. F.: The Formation and Composition of the Cerebrospinal Fluid: A Simple Method of Detecting Acidosis and Determining Hydrogen Ion Concentration, J. A. M. A. **70**:977-980 (April 6) 1918.

126. Tashiro, S., and Levinson, A.: Alkaloidal and Metallic Precipitation of Cerebrospinal Fluid in the Diagnosis of Meningitis, J. Infect. Dis. **21**:571-579, 1917.

127. Leopold, J. S., and Bernhard, A.: Studies in the Chemistry of the Spinal Fluid of Children, Am. J. Dis. Child. **13**:34-43 (Jan.) 1917.

128. Kopetzky, S. J.: The Management and Treatment of Otogenic Meningitis, Ann. Otol., Rhin. & Laryng. **47**:117-134 (March) 1938.

is also lower than that of the blood plasma taken from the meningitic patient.

Gubner stated that in studying the effect of blood transfusion on the chemistry of the cerebrospinal fluid Kopetzky [129] found that the transfusions seemed to bring the p_H toward the normal, increase the chlorides and carbonates and markedly lessen the lactic acid content of the fluid. In other words, there seems to be a trend toward the normal chemical content produced in the pathologic fluid by transfusion of whole blood.

Comparison of Blood and Fluid Content

In examination of the chemistry of the spinal fluid, Kopetzky [130] stated that a study of similar elements in the patient's blood is necessary. (See Donnan's equilibrium.[131]) They are: (*a*) the carbohydrate content; (*b*) the cerebrospinal chlorides; (*c*) the carbon dioxide content and (*d*) the lactic acid content. In addition, a study of (*e*) the p_H of the fluid as compared with that of the blood is important.

Lactic Acid.—In cases of meningitis, lactic acid in the spinal fluid is much increased over the amount in the blood. Again, then, an increase in lactic acid will be found in the blood when a continuing high fever is present.

Normally the ratio of lactic acid in the cerebrospinal fluid to that in the blood is 1 to 1, but in the presence of meningitis the lactic acid is increased in the spinal fluid over that in the blood plasma, so that the ratio becomes 3 or more to 1. In the presence of meningitis there is a drop in the chlorides, a drop in the carbon dioxide and a drop in the p_H of the spinal fluid.

Technic.—The sets of specimens should be covered with a layer of melted paraffin (of low melting point) in order to prevent evaporation and other changes which are likely to occur if the specimens are not protected when they are carried from the bedside to the laboratory and during the interval between the time they are taken and the time when they are examined. The specimens of spinal fluid should be taken in two separate sets—one portion for bacterial analysis and the other for chemical examination.

Donnan's Equilibrium.[131]—If a nondiffusible substance, e. g. protein (P), is separated from diffusible substances by a semipermeable membrane, the ions will pass in different amounts and establish an electrostatic difference, the mem-

129. Kopetzky, S. J.: Newer Concepts of Otogenic Meningitis, Laryngoscope **45**:827-838 (Nov.) 1935.

130. Kopetzky, S. J.: The Diagnosis and Treatment of Otogenic Meningitis, Pennsylvania M. J. **42**:217-225, (Dec.) 1938.

131. Hackh, I. W. D., and Grant, J.: Chemical Dictionary, ed. 2, Philadelphia, P. Blakiston's Son & Co., 1937, p. 319.

brane potential; hence the osmotic pressure within is greater than that of the outer solution. Thus, at equilibrium in *neutral* solution:

$$(Na+) \times (P) \times (Cl-) = (Na+) \times (Cl-).$$

P = protein

In an *acid* solution:

$$(Cl-1) \times (Cl- \text{ on } P) \times (H+) = (Cl-) \times (H+).$$

In a *basic* solution:

$$(Na+) \times (Na+ \text{ on } P) \times (OH-) = (Na+) \times (OH-)$$

Reduction of Chlorides in Cases of Tuberculous Meningitis

Ingham [182] found that the chlorides in the cerebrospinal fluid are diminished to a greater extent in the presence of tuberculous meningitis than in that of other infections of the nervous system. His highest figure in association with tuberculous meningitis was 550 mg. per hundred cubic centimeters. None of the other diseases was associated with a content below 580 mg. per hundred cubic centimeters, and in the vast majority of cases the value was more than 600 mg. The average figure for healthy persons is 715 mg.

Comment by Reviewer: Years ago, Greenfield called attention to the diminution in chlorides toward the end of the inflammatory process in otitic meningitis. This was later demonstrated to be of little value.[75a]—W. P. E.

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132. Ingham, J.: Sodium Chloride Content of Cerebrospinal Fluid in Tuberculous Meningitis, Brit. M. J. **2**:111-113 (July 17) 1937.

(To Be Concluded)

Clinical Notes; New Instruments and Technics

ETHER TUBE AND LIP RETRACTOR ATTACHMENTS FOR MOUTH GAG

SAMUEL PELUSE, M.D., LOS ANGELES

A standard type mouth gag to which an ether tube and lip retractors have been attached has proved useful to the tonsillectomist and the anesthetist. The ether tube attachment is flexible and out of the way of the operator (fig. 2). It needs little attention by the anesthetist and directs the ether vapor into the pharynx whether the patient's jaws are open or closed. The lip retractors prevent the lips from becoming pinched between the teeth and the metal jaws of the mouth gag.

A description of the attachments follows: One end of a flexible copper tube (fig. 1*A*) which has been brazed to the under surface of the upper jaw of the mouth gag, is hubbed for the ether hose attachment, while the other end points toward the pharynx when the mouth gag is inserted between the teeth (fig. 2). The lip retractors are rigid metal strips brazed to the shoulders of each jaw of the mouth gag (fig. 1*B*).

The ether tube and the lip retractors can be attached to any standard type mouth gag by a local manufacturer of instruments.

710 South Union.

From the Department of Otology, Rhinology and Laryngology of the University of Illinois College of Medicine.

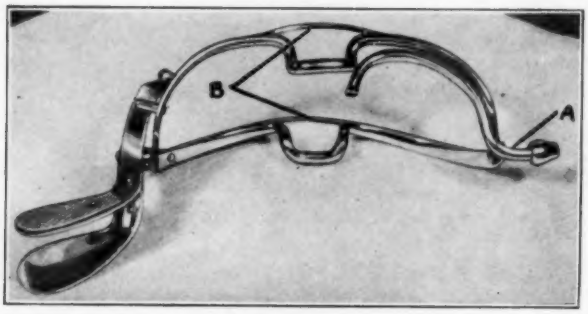

Fig. 1.—A standard mouth gag with the following attachments: *A*, a flexible copper tube, hubbed at one end for the ether hose connection; *B*, lip retractors.

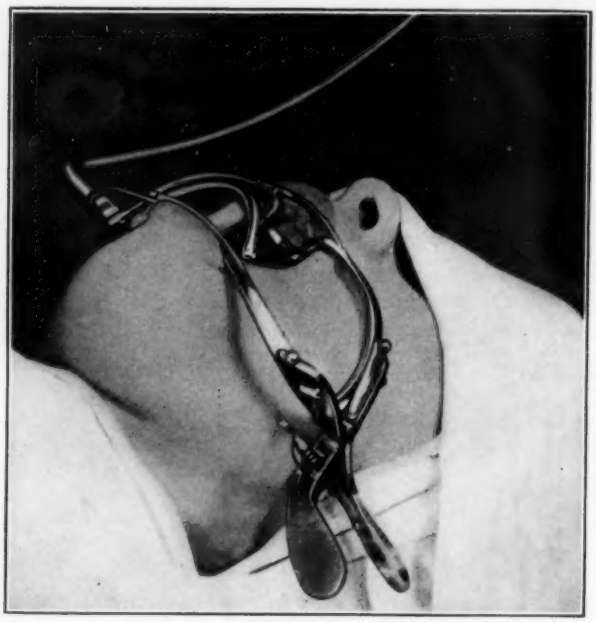

Fig. 2.—The mouth gag in place, showing the ether tube directed into the pharynx and connected with the ether hose. The lips are resting on the retractors.

Progress in Otolaryngology

Summaries of the Bibliographic Material Available in the Field of Otolaryngology

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TUMORS OF THE NOSE AND THROAT

GORDON B. NEW, M.D.
AND
JOHN B. ERICH, M.D.
ROCHESTER, MINN.

With the aid of excellent illustrations, Schürch and Fehr [1] discussed the surgical therapy of malignant metastases in the cervical lymph nodes and presented the results of surgical intervention in 113 cases. In their experience the following factors have been of much importance: 1. Block dissection on the side of the lesion must be complete, with the removal of all submental, submaxillary and deep jugular lymph nodes, together with resection of the nodes external to and deep to the sternomastoid muscle. 2. Definitely better results may be expected from surgical treatment than from irradiation. 3. The benefit to be had from dissection will be greatly reduced if the cancerous growth has broken through the capsule of the lymph nodes and has invaded the interstitial soft tissues. 4. If the condition is inoperable, occasional roentgen ray therapy may be of value. 5. In every instance in which the primary tumor reaches to or extends beyond the median line, bilateral block dissection will be necessary.

In considering malignant conditions of the nose and throat, Martin [2] reviewed the reports of 19 cases in which he was able to follow the patients to the ultimate outcome of their condition. The larynx was involved in 9 of the patients. Four were treated surgically, of whom 3 were living and well, three years, nine years and ten years respectively after the therapy, at the time of Martin's writing. Four were treated by the Coutard technic and 3 of these were living, without recurrence, 1 of whom had survived two years and eight months, at the time Martin

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From the Section on Laryngology, Oral and Plastic Surgery, the Mayo Clinic.

1. Schürch, O., and Fehr, A.: Zur Frage der operativen Behandlung von Hals- drüsenmetastasen bei bösartige Geschwülsten der Mundhöhle und der oberen Luftwege, Deutsche Ztschr. f. Chir. **251**:641-672, 1939.

2. Martin, R. C.: Malignancies of the Nose and Throat, Ann. Otol., Rhin. & Laryng. **47**:512-521 (June) 1938.

wrote. Radon was used for only 1 patient; this patient died from other causes. The reports on 5 patients who had malignant growths of the pharynx and who were treated by irradiation were presented. Of 4 who received roentgen therapy, 3 died and the fourth was living but had had a recurrence at the time of writing. One patient was treated by radon and had survived twelve years at the time of reporting. Five patients who had malignant tumors of the nose received roentgen ray or radium therapy, and 4 had been living for from two and a half years to four years and seven months at the time Martin wrote.

Lierle [3] presented several tables showing the results of treatment of 169 patients who had epidermoid carcinoma of the pharynx, buccal mucosa and larynx. These patients, seen at the University of Iowa, were observed for periods varying from three to seven years. Lierle's conclusions on the basis of his study were that all localized differentiated lesions respond better to operation or to operation with irradiation than to irradiation alone; that undifferentiated tumors do not respond well to any form of treatment, although irradiation is definitely of value, and that education in reference to early recognition of malignant lesions is an important factor in the treatment of such conditions.

TUMORS OF THE LIPS AND MOUTH

An excellent and comprehensive review of recent literature concerning tumors of the mouth and jaws was presented by Thoma.[4] Included in his study are one hundred and twenty-five articles by American and foreign authors. Although his paper is too long to be reviewed here, it is well worth reading.

Rabenalt [5] expressed a conviction that mixed tumors situated outside the parotid region are relatively rare and that the diagnosis of such neoplasms can be made only by microscopic section. One case of mixed tumor of the upper lip was reported.

According to Eggers,[6] a comparison of mixed tumors of the lips with mixed tumors of the salivary glands has shown that the former growths frequently contain more cartilage and less stratified squamous epithelium than do the latter. He presented a table in which 64 cases of mixed tumor of the lips reported in the literature are reviewed. This table reveals that cartilagenous tissue was discovered in 48 per cent of

3. Lierle, D. M.: Epidermoid Carcinoma of the Pharynx, Buccal Mucosa and Larynx, J. Iowa M. Soc. **29**:116-118 (March) 1939.

4. Thoma, K. H.: Tumors of the Mouth and Jaws: Collective Review, Internat. Abstr. Surg. **67**:522-545, 1938; in Surg., Gynec. & Obst., December 1938.

5. Rabenalt, H.: Ueber einen gutartigen Mischtumor der Oberlippe, Zentralbl. f. Chir. **65**:2647-2648 (Nov. 26) 1938.

6. Eggers, H. E.: Mixed Tumors of the Lip, Arch. Path. **26**:348-353 (July) 1938.

the 64 tumors and that stratified squamous epithelium was found in 12 per cent of them. Eggers reported a case of mixed tumor of the upper lip in which a man aged 69 was the patient; evidently this neoplasm had traumatic antecedence.

Newell [7] made a study from a clinical and pathologic point of view of 390 cases of carcinoma of the lips. His tables revealed that there were 344 cases of squamous cell carcinoma, 44 cases of basal cell carcinoma and 2 cases of adenocarcinoma. As compared with 336 malignant lesions of the lower lip, only 54 involved the upper lip. Five year follow-up examinations of the patients, obtained in 328 of 390 cases, were selected as the best index to results secured in treatment. In this series, the percentage of five year cures amounted to 61.6 per cent. The results of treatment were reported for three groups of patients: In group 1, excision alone of the local lesion of the lip was performed on 176 patients in whom there was no clinical evidence of cervical metastases; the author's statistics demonstrated that five year cures amounted to 80.9 per cent in this group. Group 2 included patients for whom local excision and dissection of the cervical glands were carried out but in whom no metastases were found microscopically; the percentage of five year cures in this group was 85.3 per cent. Group 3 consisted of 83 patients who had undergone both local excision and dissection of the cervical glands and in whom metastases were discovered; the percentage of five year cures in this group was 22.5. Of interest in this article is a table prepared from reports in the literature; it presents a comparison of five year results in patients who had carcinoma of the lip treated by operation, irradiation and dermatologic methods, respectively. The percentage of five year cures obtained by these various methods, as demonstrated in this table, all ranged between 80 and 90.

Padgett [8] discussed the treatment of carcinoma of the lip. From the standpoint of therapy, he divided the local lesions into five groups: (*1*) keratotic lesions which may extend along as much as half of the junction of the vermilion border of the mucous membrane with the skin; such lesions occur as keratotic leukoplakia, and removal may be accomplished by excision of a strip of mucosa along the edge of the lip; (*2*) small, fairly well localized lesions, of from 0.5 to 2 cm. in diameter, which may be treated equally well by V-shaped excision or by the use of radium or roentgen rays; (*3*) rather diffuse ulcers extending somewhat superficially along a considerable part of the lip, concerning which

7. Newell, E. T., Jr.: Carcinoma of the Lip: Clinical and Pathologic Study of Three Hundred and Ninety Cases, with Report of Five Year Cures, Arch. Surg. **38**:1014-1029 (June) 1939.

8. Padgett, E. C.: Treatment of Cancer of the Lip, J. Missouri M. A. **36**: 154-157 (April) 1939.

Padgett stated the belief that the best therapeutic results could be obtained by the proper application of radium; (*4*) diffuse lesions which would leave a large defect even if they could be controlled by irradiation; in such instances, wide excision was recommended with immediate or late plastic repair, and (*5*) lesions which are fairly well fixed or which already involve the bone, concerning which the author favored radical excision, followed by thorough cauterization of the bone.

In regard to the question of cervical metastases in cases in which the nodes are probably not involved, Padgett took into consideration the following factors before undertaking dissection of the nodes: (*1*) the size and state of advancement of the local lesions; (*2*) the pathologic picture of the lesion (grade 1 epitheliomas require no cervical block dissection, whereas those of grade 4 are better irradiated than dissected); (*3*) the age and general condition of the patient; (*4*) the probable percentage of eventual metastases for a given type of lesion; (*5*) the probable mortality in patients with bilateral submaxillary dissection of the neck; (*6*) the presence of metastases (if invisible cervical metastases are present, Padgett expressed the opinion that the sooner dissection of the neck is done, the greater is the probability of success, providing that the lesion is not of high grade malignancy); and (*7*) the possibility of the surgeon's being able to follow up the patient for a long period.

Swinton and Trommald [9] reported 52 cases of carcinoma of the lower lip in which the patients were treated at the Lahey Clinic. They recommended excision of the local lesion, with performance of a subsequent plastic operation to gain sufficient length for the lower lip. In reference to the cervical nodes, the authors did not recommend glandular dissection or cervical irradiation if the local lesion was of grade 1 malignancy, was less than 1 cm. in diameter, was of short duration or was not deeply infiltrated or ulcerated or if there was no evidence of extension into the cervical nodes. In cases in which dissection of a gland or glands was required the authors expressed the opinion that if the local lesion were entirely confined to one side of the lip, resection of the submental and submaxillary nodes on only the involved side was indicated; but if the lesion were situated near the midline, bilateral dissection of glands was essential. If metastases were found, they recommended postoperative administration of radiation therapy in addition to block dissection. They were able to obtain complete data concerning 27 of 52 patients. In this group of patients, followed from one to ten years, there had been only two recurrences at the time of writing.

9. Swinton, N. W., and Trommald, J.: Carcinoma of the Lip, S. Clin. North America **18**:599-603 (June) 1938.

At the surgical clinic in Maribor, Yugoslavia, Jehn [10] stated, one method is used in the treatment of cancer of the lower lip: excision of the lesion, as advocated for the first time by Celsus. According to the author, excellent cosmetic results may be effected by this procedure.

Seventy-nine patients who had epithelioma of the lips and face and who were treated by roentgen therapy were 100 per cent free of symptoms at the time of writing, according to a report made in 1938 by Hrabovszky.[11] However, the patients were not observed over any long period, a fact which the author readily admitted.

In an interesting discussion of contact implantation of cancer, Charache [12] reported a case in which there were epitheliomas of the upper and lower lips directly opposite each other. Both lesions were diagnosed as "prickle-cell carcinomas," and in the author's opinion it is reasonable to assume that the growth on the upper lip resulted from contact implantation from the cancer on the lower lip. He further stated that contact implantation of cancer is difficult to prove. A number of such cases have been reviewed in the literature, but only 1 case of cancer of the lip caused by contact was reported prior to the one which Charache presented.

Körbler [13] advised the use of radium for the treatment of cancers of the lip but recommended surgical removal of the cervical lymph nodes in such instances. Dissection of glands, however, is unnecessary in the case of very small lesions of the lower lip and in the case of cancers of the upper lip.

On studying metastatic involvement of the cervical nodes in cases of cancer of the upper lip, Ducuing [14] concluded that glandular involvement is more constant in instances of cancer of the upper lip than with similar lesions of the lower lip. This statement was based on experience with 26 of his own patients who had no cervical involvement at the time the labial lesion was treated with radium; in 12 per cent of the patients cervical metastases developed. Also studied were 32 cases of cancer of the upper lip in which observations were made by Ducuing's colleagues, M. Delarue and Mme. Fayein. Of the 32 patients considered, 7 were definitely free of cervical involvement when radium was applied to the labial lesion; all 7 subsequently suffered from malignant

10. Jehn, W.: Die Operation des Unterlippenkarzinoms, Zentralbl. f. Chir. **66**:796-798 (April 8) 1939.

11. Hrabovszky, Z.: Ueber die primären Erfolge der Nahbestrahlung von Haut- und Lippenkrebsen, Strahlentherapie **62**:691-695, 1938.

12. Charache, H.: Contact Implantation of Cancer; Carcinoma of Upper and Lower Lips, New York State J. Med. **38**:1400-1401 (Nov. 1) 1938.

13. Körbler, J.: Zur Radiumbehandlung der Haut- und Lippenkrebse, Strahlentherapie **62**:507-515, 1938.

14. Ducuing, J.: L'évidement prophylactique dans le traitement du cancer de la lèvre supérieure, Bull. Assoc. franç. p. l'étude du cancer **27**:205-207 (March) 1938.

invasion of the cervical lymph nodes. However, since no mention was made of the degree of malignancy of the local lesions or of the response of these lesions to radium therapy, this article is not entirely convincing.

In conjunction with a good discussion on leiomyomas involving the alimentary tract and the skin, Stout [15] reported on 2 such neoplasms involving the tongue. One which developed at the base of the tongue was of a vascular nature and was thought to be derived from smooth muscle fibers of blood vessels. The other, a pedunculated tumor on the dorsum of the tongue, was considered to arise from a dysontogenetic circumvallate papilla. Four other leiomyomas removed from the oral cavity were reported. By way of explanation of the apparent rare occurrence of leiomyomas in the oral cavity, the author suggested that the paucity of smooth muscle tissue in this part of the body is an important factor.

Lepp [16] reported a case of mixed tumor in the mouth. This neoplasm became malignant possibly because of a persistent infection (chronic marginal osteitis) around the paradental membrane of a wisdom tooth. The micropathologic development of the tumor is described.

Four cases of epidermoid cysts involving the floor of the mouth were presented by Shore.[17] Each cyst was lined with stratified squamous epithelium, and 2 contained hair and hair follicles. Shore emphasized the importance of surgical excision of such cysts while they are small and uninfected and condemned the practice of attempting to obliterate them by injecting sclerosing solutions into their cavities.

Figi and Dix [18] reported on a dermoid cyst of the floor of the mouth in a man aged 30. The growth was so large that it crowded the tongue upward and backward. Symptoms were difficulty in talking, chewing and swallowing and slight dyspnea. By blunt dissection, this tumor was removed through an incision in the floor of the mouth. It measured 8 by 6.5 by 4 cm., was lined with stratified squamous epithelium and contained epithelial cells and keratin.

With a general discussion of tumors and diseases of the mouth, Stuart [19] discussed particularly leukoplakia, fibroma, lipoma, papilloma,

15. Stout, A. P.: Leiomyoma of the Oral Cavity, Am. J. Cancer **34**:31-36 (Sept.) 1938.

16. Lepp, H.: Zur Kenntnis des papillär wachsenden schleimigen Cystadenokarzinoms der Mundhöhle, Beitr. z. path. Anat. u. z. allg. Path. **102**:164-186, 1939.

17. Shore, B. R.: Sublingual Epidermoid Cysts, Ann. Surg. **108**:305-308 (Aug.) 1938.

18. Figi, F. A., and Dix, C. R.: Dermoid Cysts of the Floor of the Mouth: Report of Case, Proc. Staff Meet., Mayo Clin. **14**:289-293 (May 10) 1939.

19. Stuart, C. W.: Tumors of the Mouth, J. Am. Dent. A. **25**:1754-1761 (Nov.) 1938.

blood dyscrasia and leukemia. At the end of his article, he emphasized the importance of attempting to arrive at a diagnosis by means of a biopsy before undertaking any treatment for a tumor of the mouth. Furthermore, he stressed the fact that the extraction of teeth in a carcinomatous region reduces the chances of curing the patient.

Ivy [20] presented a good general discussion of the following tumors which involve the mouth and jaws and with which, as he stated, the medical profession as a whole is not familiar: (*1*) dentocystic tumor, (*2*) localized osteitis fibrosa, (*3*) benign giant cell tumor, (*4*) sarcoma, (*5*) metastatic growths and (*6*) traumatic or hemorrhagic cyst.

A discussion of precancerous lesions of the mouth, particularly leukoplakia, was given by Quick.[21] He described avoidable cancers which have their beginning in neglected chronic inflammatory changes referable to dental neglect and to local and general causes of irritation in the mouth. Any erosion or ulceration which has resisted ordinary measures of treatment for more than a month he regarded as potentially precancerous, and he stated the belief that biopsy should be resorted to promptly and frequently. Radium and roentgen rays are not suitable agents for the eradication of leukoplakia. Instead, he reported that he uses a bipolar cutting current of low intensity and shaves off the questionable region, leaving a minimal residue of scar.

Jones [22] presented a brief and rather general discussion of tumors of the mouth. Special emphasis was placed on the treatment of intraoral cancers.

An interesting study of osteoradionecrosis of the jaws was presented by Watson and Scarborough,[23] who reviewed the cases of a series of 1,819 patients with intraoral cancers treated in the hospital by roentgen or radium therapy. Of these, 235 patients, or 13 per cent, subsequently were afflicted by osteoradionecrosis. Three etiologic factors were considered to be involved in the production of osteoradionecrosis: heavy irradition, trauma and infection. Sequestration is slow, and regeneration of bone seldom, if ever, occurs, but healing is usually rapid after the necrotic bone has separated. More frequent and serious are complications involving the mandible, as compared with those of the upper jaw. Furthermore, cancers of the alveolar ridge and of the floor of the mouth are most likely to initiate osseous complications. The

20. Ivy, R. H.: Tumors of the Mouth and Jaws, Delaware State M. J. **10**: 147-152 (July) 1938.

21. Quick, D.: Leukoplakia and Allied Mouth Conditions, Canad. M. A. J. **40**:234-239 (March) 1939.

22. Jones, G. W.: Tumors of the Oral Cavity, Southwestern Med. **23**:70-72 (March) 1939.

23. Watson, W. L., and Scarborough, J. E.: Osteoradionecrosis in Intraoral Cancer, Am. J. Roentgenol. **40**:524-534 (Oct.) 1938.

average period of disability suffered by patients who were afflicted by osteoradionecrosis in the authors' series of cases was eleven months; the longest period was eight years and seven months. When osteoradionecrosis is once established, conservative treatment must be instituted until sequestration occurs. The authors stated that the prognosis of osteoradionecrosis is poor.

Trueblood [24] offered a long discussion of tumors, particularly those of a malignant nature, involving the lips and oral cavity. He stressed the importance of early diagnosis, which, he stated, if it could be achieved should eliminate deaths from cancer of the lips and mouth. His general method of treatment of malignant lesions of the lips and oral cavity follows: A cancer of the tongue of small dimensions and involving the anterior third of the tongue may be removed surgically. But in treating other carcinomas of the tongue, resort to radium implantation is advisable. For cancer of the floor of the mouth, radium should be used. For cancer of the buccal surface surgical intervention may be used, because excess tissue is available. Cancer of the roof of the mouth, if it does not originate in the antrums, may be treated with cautery or radium. For cancer of the dental ridge, radium therapy or the use of a hot iron is preferable. Small lesions of the lip can be treated with either radium or surgical intervention, but those of large dimensions require irradiation. However, large cancers of the lip which require a heavy dose of irradiation for cure are better treated by radical surgical operation. For cervical metastases, no treatment should be instituted if there are no palpable nodes present, but the patient should be carefully watched for the possible development of malignant nodes. In instances of glandular involvement, dissection of the glands is recommended. Apparently, Trueblood based his therapy of malignant lesions of the lips and mouth not on the grade or activity of the tumor but on the size and situation of the lesions.

Gardham [25] discussed his experience gained in the cure of 84 instances of carcinoma of the mouth. After describing the pathologic aspects and treatment of these tumors, he concluded that such growths can be divided into three classes, designated as A, B and C. Class A refers to neoplasms which are excisable and do not show any of the characteristics of high malignancy. It includes most carcinomas of the lips and the majority of small carcinomas of the cheeks. For growths of this class, both operation and irradiation give excellent results. If metastases were not present, the author did not favor prophylactic irradiation over the neck but preferred regular observation of the patient.

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24. Trueblood, D. V.: Tumors of the Lip and Oral Cavity, West. J. Surg. **46**:395-411 (Aug.) 1938.

25. Gardham, A. J.: The Classification of Buccal Neoplasms in Relation to Treatment and Prognosis, Lancet **1**:677-681 (March 25) 1939.

He stated the belief that glands which increase so rapidly that they become unsuitable for operation in three months, between one routine observation and the next, are unsuitable for operation from the beginning. Class B is comprised of growths which cannot be excised but which, again, show none of the characteristics of high malignancy. To this class belong carcinomas of the floor of the mouth. These are curable by irradiation unless they actually involve bone. When bone is involved these are the only neoplasms in the oral cavity which require mutilating operations. Class C includes growths which exhibit the signs of high malignancy. A large proportion of instances of carcinoma of the mouth belong to class C. Operations for treatment of patients who have such lesions must be extensive and mutilating and therefore are seldom justifiable. On the other hand, irradiation is useful except in the case of an infiltrating carcinoma of the lower jaw, in which event irradiation will not impede the progress of the growth without risking necrosis of the jawbone.

According to Ducuing and Nègre,[26] cancer of the floor of the mouth is rare. Of 9,504 carcinomas of the body, only 40, or 0.4 per cent, involved the floor of the mouth. In the order of frequency, the symptoms of cancers in this region are adenopathy, pain in the lower jaw or in teeth of the lower jaw, ulceration, local pain and in some instances earache. The authors classified cases of malignant lesions in the floor of the mouth in the following manner: type 1, those in which the cancer is limited to the floor and is freely movable; type 2, those in which the lesion infiltrates the gums without glandular involvement, and type 3, those in which there is glandular involvement. The treatment carried out for patients in the authors' 40 cases varied; radium alone, radium with surgical treatment and roentgen rays or radium with electrocoagulation were the methods employed. On the whole, the results of treatment were poor; only 1 patient, treated with radium, was living after three years, at the time of the authors' reporting.

Logsdon[27] discussed malignant lesions of the oral cavity and emphasized the responsibility of the dental profession in detecting precancerous and early malignant lesions of the mouth. His observations were based on a group of 6,037 patients suffering from tumor admitted to the Veterans Administration Facility at Hines, Ill. In this group, 20 per cent of the tumors were situated in the oral cavity. He mentioned the fact that the mortality during a seven year period among patients who had these oral tumors was only 30 per cent.

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26. Ducuing, J., and Nègre, P.: Le cancer du plancher buccal, Bull. Assoc. franc. p. l'étude du cancer **27**:349-354 (May 16) 1938.

27. Logsdon, C. M.: Malignancy of the Oral Cavity Region, J. Am. Dent. A. **26**:879-883 (June) 1939.

In an excellent discussion of the characteristics and histologic observation of Bowen's disease, Stout [28] reported on a patient who had a lesion in the floor of the mouth which was diagnosed histologically as Bowen's disease. Although cervical metastases had developed in this case, thorough microscopic examination of the oral lesion showed no evidence that the basement membrane had been penetrated. Evidently the penetration that had occurred was only microscopic in degree.

TUMORS OF THE NOSE

Hagens [29] described a case in which congenital dermoid cyst and fistula of the dorsum of the nose had afflicted a boy aged 4 years. This cyst had two extensions, one between the nasal bones and the other directed forward to the side of the nose.

In an interesting report on benign granuloma (so-called sarcoid tumor) of the nose, Kistner and Robertson [30] stated that although they had found reference in the literature to involvement of the nasal bones, they had not encountered a report of involvement of the nasal mucosa. In the case which they reported the granuloma afflicted a woman aged 50, who had noticed an increase in the size of the bridge of her nose and pain in this region. The granuloma involved the nasal mucosa, nasal bones and overlying skin. The authors remarked that considerable difficulty was encountered in arriving at a final diagnosis because of the unusual involvement of the nasal bones and nasal mucosa. Not until the overlying skin became involved in the process was the diagnosis evident.

Gaté and Cuilleret [31] gave an account of a single case in which a lesion (probably a sarcoid tumor) occurred on the dorsum of the nose. This growth was ten years old and suggested a tuberculous lesion. However, the pathologic picture favored a pilosebaceous lesion of a chronic nature, probably a sarcoid.

Mittermaier [32] cited the work of McClure and Aldrich, who in 1923 found that the intracutaneous injection of a saline solution into patients suffering from edema caused fast absorption of the fluid. Mittermaier advised the use of a diet ranging from salt poor to salt free in the treat-

28. Stout, A. P.: Malignant Manifestations of Bowen's Disease, New York State J. Med. **39**:801-809 (April 15) 1939.

29. Hagens, E. W.: Congenital Dermoid Cyst and Fistula of Dorsum of the Nose: Report of a Case, Arch. Otolaryng. **28**:399-403 (Sept.) 1938.

30. Kistner, F. B., and Robertson, T. D.: Benign Granuloma of the Nose (So-Called Sarcoid), J. A. M. A. **111**:2003-2005 (Nov. 26) 1938.

31. Gaté, J., and Cuilleret, P.: Lésion tumorale chronique du nez d'aspect sarcoïdal constituée par des proliférations pilo-sebacées, Bull. Soc. franç. de dermat. et syph. **45**:1409-1410 (July) 1938.

32. Mittermaier: Ueber Polyposis nasi und Ödembereitschaft, Ztschr. f. Hals-, Nasen- u. Ohrenh. **44**:239-243, 1938.

ment of patients suffering from nasal polyposis with edema of the mucous membranes. No cases were reported.

Hargett [33] discussed the comparative pathologic aspects of nasal polyps and keloids and concluded that (*1*) nasal polyps are fibromas; (*2*) they have a keloid-like tendency to return after removal, and (*3*), as is true of a keloid, this tendency to return in some cases can be prevented or partially prevented by the use of high voltage roentgen therapy. Attention was directed to the theory of cellular injury in the development of polyps, and the rhinologist was urged to remove the source of this injury when he removed the polyps.

An extensive study of the subject of the relation between polyps of the nose and infection of the paranasal sinuses was made by Podvinec.[34] The article may be summarized as follows: The origin of nasal polyps is in, and therefore depends on, preformed anatomic duplication of the mucous membrane about the natural ostia leading to the paranasal sinuses. A chronic catarrhal inflammatory process is the basic cause of the change in the mucous membrane at this point, and this change leads to the formation of what are called "polyps." There is a distinct tendency for polyps to recur; this is the result of persistence of the chronic catarrhal condition and also of the continued presence of duplications of the membrane. Antrochoanal polyps arise in the same manner and from the same cause. They do not arise in the sinus, according to Podvinec. Polyps once formed may pass secondarily into the sinus. Just before the development of polyps, the paranasal sinuses are healthy. It is only secondarily and in a definite manner that they become infected. Only in rare instances does a primary infection of a sinus produce polyps, and in such instances polyps originate in exactly the manner previously described. In cases of extensive formation of polyps, there is usually secondary development of pansinusitis. If nothing in the way of therapy is undertaken, the result is chronic suppurative pansinusitis. Podvinec stated that he did not believe that ethmoiditis plays any part in the development of polyps of the nose or that the necrosing ethmoiditis of Woakes exists. The treatment of polyps is always surgical, and the essential point is resection of the middle meatus. In those cases in which the sinuses are involved, the surgical treatment must include them as well as the other structures.

In an interesting article, Kern and Schenck [35] classified polyps of the nose in the following manner: (*1*) mucous polyps (myxoid polyps),

33. Hargett, E. R.: Discussion of the Relation of Nasal Polyps to the Keloid, Laryngoscope **48**:870-876 (Dec.) 1938.

34. Podvinec, S.: Les relations entre les polypes du nez et les affections des cavités paranasales, Ann. d'oto-laryng, March 1939, pp. 266-282.

35. Kern, R. A., and Schenck, H. P.: The Diagnosis and Treatment of Mucous Nasal Polyps, with a Consideration of the Allergic Factor, M. Clin. North America **22**:1633-1643 (Nov.) 1938.

(*2*) mixed polypoid hyperplasia, (*3*) papillary hypertrophy or mulberry polyps and (*4*) malignant polyps, which are comparatively rare and include carcinomatous, sarcomatous and neurogenic polyps. Special attention was given to the allergic factor. The authors wrote: "The whole situation may be summed up in these words: Complete and accurate diagnosis of the anatomical lesions in nose and sinuses; recognition of all the substances to which the patient is sensitive; thorough correction of the anatomical defects by proper surgical procedure; thorough handling of the allergic factors involved; systematic recheck of all factors to guard against relapse; the treatment of the whole patient, not merely of his nose."

Scott-Brown [36] reported 47 cases of allergic rhinitis with polypi. In these cases infection either was absent or was present and was treated by free intranasal drainage at the time of removal of the polyps. All patients were treated by the insertion of radium needles into the ethmoid region three weeks after removal of the polyps. Nearly all the patients who were treated during a four year period were symptom free at the time the article was written.

Ford [37] described the dosage and technic of the use of radium postoperatively for nasal polyps. In his experience one hundred and twenty-five hours has proved adequate in all cases. He stated that the action of radium destroys tissue and prevents recurrence of nasal polyps. Less screening of the applicator and less exposure time cut down the effect of gamma rays and increase the action of beta rays, which are the most effective in this particular condition.

Two instances of melanoma of the nasal cavity, the patients being a woman aged 60 and a man aged 35, were reported by Smith.[38] He described four theories of origin of these tumors and presented the following features of interest in the 2 instances: (1) ordinarily, a malignant melanoma is thought to have its origin in a nevus on the surface of the skin, but it may occur in tissues undergoing transition from cutaneous to mucosal surface, as in the nasal vestibule and rectum; (2) a malignant melanoma may be either pigmented or nonpigmented; (3) growth of the primary lesion may be slow as compared with the rapid dissemination of the metastatic tumors. Smith recommended radical removal of lesions of this type, considering that to gain adequate exposure performance of either lateral rhinotomy or a Denker operation

36. Scott-Brown, W. G.: The Use of Radium in Allergic Rhinitis with Polypi, J. Laryng. & Otol. **53**:459-464 (July) 1938.

37. Ford, W. A.: Postoperative Use of Radium for Nasal Polyps, Arch. Phys. Therapy **20**:232-235 (April) 1939.

38. Smith, A. T.: Primary Melanoma of the Nasal Cavity: Report of Two Cases, Arch. Otolaryng. **29**:437-445 (March) 1939.

beneath the upper lip is necessary. In Smith's second case he ligated the external carotid artery to control bleeding.

McKenzie [39] reported a case of melanoma of the nose in which the lesion afflicted a man aged 72. The tumor filled the entire right nasal cavity and extended into the nasopharynx through the right choana. Employing lateral rhinotomy to gain exposure, destruction of the entire growth was accomplished by means of surgical diathermy. The author described briefly the theories of origin of such a tumor.

An interesting article on osteoma of the paranasal sinuses and mastoid process was presented by Hempstead.[40] He stated that these bony tumors are uncommon and that their causation never has been determined. They may be either hard or spongy, or they may consist of a mixture of the two types. The patients usually seek medical advice because of pain, external deformity or symptoms of intracranial complications; occasionally, the growths are found accidentally on roentgenologic examination. Hempstead stated the belief that most osteomas which are accompanied by mucocele can be removed through the frontoethmoid incision and that unless the dura or cribriform plate is involved it is illogical to use the method of Cushing in surgical treatment. If osteomas are associated with intracranial complications and with definite infection of the sinuses, operation might be done in two stages. Two cases were reported, in 1 of which the left ethmoid region was involved, and in the other the left mastoid. Both of the patients did well after simple removal of the osteomas.

TUMORS OF THE NASOPHARYNX

Doyle [41] presented a case of fibroma of the nasopharynx in which the lesion afflicted a girl aged 17. The tumor occluded both choanae, bulged the soft palate forward and projected downward below the margin of the soft palate. Since this tumor was attached by a narrow pedicle in the left vault of the nasopharynx, it was removed by a large tonsil snare inserted through the left nasal cavity to the nasopharynx and manipulated about the tumor with a finger through the mouth. It was reported histologically as being a telangiectatic edematous myxofibroma.

Schlesselman [42] described a snare improvised from a Tydings tonsil snare for the removal of pedunculated neoplasms in the nasopharynx.

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39. McKenzie, W. S.: A Case of Melanoma of the Nose, J. Laryng. & Otol. **54**:93-94 (Feb.) 1939.

40. Hempstead, B. E.: Osteomas of the Paranasal Sinuses and the Mastoid Process: Report of Cases, J. A. M. A. **111**:1273-1275 (Oct. 1) 1938.

41. Doyle, G. F.: Report of a Case of Telangiectatic Edematous Myxofibroma of the Nasopharynx, Kentucky M. J. **36**:421-423 (Oct.) 1938.

42. Schlesselman, J. T.: A Nasopharyngeal Snare and a Nasal Splint, Arch. Otolaryng. **29**:988-989 (June) 1939.

This instrument is inserted through the mouth into the nasopharynx and, as the author stated, greatly facilitates the removal of such growths.

Gaus [43] reported a case of chondroma of the nasopharynx. He cited Coenen as stating the belief that such tumors develop from the remains of cartilage concerned with the development of the chondrocranium. Other investigators have stated that the tumors originate from cells of cartilage derived from the cartilaginous portion of the eustachian tube. The patient in Gaus's report had a large tumor in the nasopharynx. Biopsy showed it to be chondroma. The tumor was removed by Denker's method, and the patient's postoperative course was uneventful.

Chordomas, which are of notochordal origin, were classified by Redpath [44] as cranial, vertebral or supracoccygeal. The author presented a fine discussion of the subject and reported 2 cases of spheno-occipital chordoma. Prior to this report only 12 tumors of this type had been reported in the American literature. Redpath stated that chordomas have a characteristic histologic picture which can be confused with myxochondroma or colloid carcinoma. The diagnosis is based on roentgenologic observations, the results of biopsy and the following signs and symptoms: (*1*) a gradual onset of nasopharyngeal and neurologic symptoms in middle-aged patients, (*2*) the presence of an obstructing midline nasopharyngeal tumor, (*3*) progressive bilateral palsy of the cranial nerves, which may be rather widely separated, with little or no evidence of intracranial hypertension, (*4*) sensory as well as motor manifestations and (*5*) symptoms arising from compression of the brain stem or of the upper cervical portion of the spinal cord. Chordomas involving the nasopharynx may be confused with tumors of Rathke's cleft. They may be confused with adenomas and carcinomas of the hypophysis which destroy a considerable amount of bone, but a chordoma never shows evidence of hypophysial dysfunction. Chordoma also may be confused with craniopharyngiomas. However, craniopharyngiomas occur only in children. Parasellar meningiomas also require differential diagnosis to distinguish them from chordomas. Redpath stated that the prognosis is bad and that treatment is usually of little benefit.

Custodis [45] reported 3 cases of epipharyngeal neoplasms, in all of which the patients showed symptoms from the fifth and sixth cranial nerves and from the sympathetic nervous system. Two tumors were epitheliomas, and the third was a chondroma. Custodis cited New, who reported 79 cases in 1922.

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43. Gaus, W.: Ein Beitrag zur Pathologie und Klinik der sogenannten gutartigen Nasenrachengeschwülste, Ztschr. f. Hals-, Nasen- u. Ohrenh. **43**:444-450, 1938.

44. Redpath, R. F.: Chordoma of the Nasopharynx: Report of Two Cases, Ann. Otol., Rhin. & Laryng. **47**:649-658 (Sept.) 1938.

45. Custodis, E.: Augensymptome bei Epipharynxtumoren, Klin. Monatsbl. f. Augenh. **101**:49-64 (July) 1938.

An excellent description of the clinical and pathologic features of cancer of the nasopharynx was provided by Martin,[46] who discussed in particular the complications, such as involvement of the lymph nodes, general metastases and intracranial extension. Martin presented 6 cases, in 2 of which osteoarthropathy was present but in which there was no disease of the heart or lungs to account for this condition. Martin accounted for the development of osteoarthropathy in patients suffering from carcinoma of the pharynx as referable to severe anemia with cachexia and malnutrition. Emphasizing the fact that malignant tumors of the nasopharynx are rarely diagnosed early, he stated that their presence is often overlooked even when the symptoms resulting from intracranial extension, cervical adenopathy and mediastinal involvement appear. He recommended the administration of intensive irradiation to all the known paths of extension while the lesion is still limited to the nasopharynx. This procedure, he stated, should improve the end results.

Hauser and Brownell[47] considered the problem of cancer of the nasopharynx and stressed the importance of diagnosis. They stated the belief that the general practitioner should be aware of the relatively common occurrence of this disease and of the symptoms and signs which lead to a correct diagnosis. They presented 5 typical cases. In conclusion, they stated that malignant neoplasms of the nasopharynx often manifest themselves by symptoms which are extranasal, namely, cervical swellings, changes in the tympanic membrane, unilateral deafness, pain in the head or throat, diplopia or paralysis of the rectus lateralis muscle or unilateral paralysis of the cranial nerves. The presence of any of these symptoms calls for careful examination of the nasopharynx. Irradiation, they stated, at present is the only valuable form of treatment, and they emphasized the importance of careful routine nasopharyngeal inspection by the otolaryngologist.

After a brief discussion of malignant tumors of the nasopharynx and paranasal sinuses, Weinberger[48] reported 3 cases. In the first there was a grade 2 cancer of the right side of the nasopharynx; in the second, a grade 3 carcinoma of the lateral nasal wall on the right, and in the third, a fibrosarcoma of the posterior portion of the ethmoid process. The author stated that from a review of the large experience of others, it appears that more and more emphasis is being placed on irradiation, regardless of the classification of the tumor, which is of secondary

46. Martin, C. L.: Complications Produced by Malignant Tumors of the Nasopharynx, Am. J. Roentgenol. **41**:377-390 (March) 1939.

47. Hauser, I. J., and Brownell, D. H.: Malignant Neoplasms of the Nasopharynx, J. A. M. A. **111**:2467-2473 (Dec. 31) 1938.

48. Weinberger, N. S.: Malignant Tumors of the Nasopharynx and Paranasal Sinuses, Ann. Otol., Rhin. & Laryng. **48**:203-211 (March) 1939.

importance. He also expressed the belief that the more highly malignant these tumors of the nasopharynx and nasal sinuses are, the more reliance may be placed on irradiation.

Brunner [49] discussed an interesting case of carcinoma of the epipharynx in which there was much destruction of the base of the skull; this neoplasm was associated with metastatic tumors involving the left lateral wall of the hypopharynx and the left piriform sinus. These metastases, in the opinion of the author, take place through the regional lymphatic vessels, whereas metastases in the lungs and pleura, which are common in the presence of carcinoma of the epipharynx, take place through the blood stream. Also associated with the primary carcinoma of the epipharynx reported by Brunner was a carcinoma of the nasal surface of the soft palate; since the two lesions were identical in microscopic structure, he expressed the opinion that the carcinoma of the soft palate was a carcinoma arising by means of contact from the carcinoma of the epipharynx.

Wagers [50] reported a case of round cell sarcoma of the nasopharynx in which the lesion afflicted a boy aged 15. This growth was treated by external irradiation and later by the implantation of radium needles into the mass of the tumor in the nasopharynx. After the treatment there had been no sign of recurrence for six years at the time Wagers wrote. The author attributed this apparent cure to the fact that the tumor was discovered at a comparatively early stage, before it had undergone much extension into the surrounding tissues.

Bradford [51] reported a case of lymphoepithelioma in which the lesion involved the left side of the nasopharynx of a boy aged 11 years. Under roentgen therapy, the tumor disappeared, and the patient had remained symptom free for twenty-one months at the time Bradford wrote. This case is of interest because the chief symptoms of the patient were related to diseases of the middle ear and mastoid processes. On roentgenologic examination considerable resorption of bone was found in the left mastoid process; also there was a lack of definition in the left temporal bone and throughout the petrous pyramid.

Accompanied by excellent photomicrographs, 8 cases of lymphoepithelioma in the nasopharynx were presented by Capps.[52] He discussed in particular the signs and symptoms of such growths. He favored the use of roentgen therapy of high voltage and the application of radon or

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49. Brunner, H.: Carcinoma of the Epipharynx: A Peculiar Case, Arch. Otolaryng. **29**:544-549 (March) 1939.

50. Wagers, A. J.: Sarcoma of the Nasopharynx, with Report of a Case, Laryngoscope **48**:302-308 (May) 1938.

51. Bradford, G. E.: An Unusual Case of Lymphoepithelioma of Nasopharynx: Case Report, Laryngoscope **48**:309-313 (May) 1938.

52. Capps, F. C. W.: Lympho-Epithelioma in the Nasopharynx, J. Laryng. & Otol. **54**:133-140 (March) 1939.

radium over the lesion. At the time of reporting his series, 1 patient was alive and well after three and a half years and another was alive after two years, but both of them had only the primary lesion; no metastases were evident. The remaining 6 patients all died within one year after the initial examination.

Blady [53] described an ingenious instrument for applying radium or radon in the nasopharynx. It is mechanically adjustable, so that the container of radium can be applied directly over the tumor.

Cappell [54] investigated 122 new growths in the nasopharynx, tonsils and pharynx. Of these, 64 per cent were classified as squamous epithelioma, 8 per cent were peribuccal mixed tumors and 4.5 per cent were miscellanous neoplasms, such as malignant rhabdomyoma. This article is concerned chiefly with the pathologic aspects and clinical features of lymphoepithelioma. The author has observed 21 cases, in which 4 patients had survived more than four years after radiation therapy, at the time at which he wrote. Emphasis was laid on the absence of harmful results following the taking of tissue for biopsy. Presented were reports of 9 cases, in 8 of which there was lymphoepithelioma of the nasopharynx or tonsils and in 1 of which there was malignant rhabdomyoma of the soft palate.

TUMORS OF THE LARYNX AND LARYNGOFISSURE

We [55] presented a complete and comprehensive article on benign tumors of the larynx in 1938. All types of benign tumors of the larynx which had been encountered at the Mayo Clinic to the year 1938 are included, with special emphasis on the pathologic aspects and treatment. The discussion is based on a series of 722 cases in which the patients were seen during a thirty year period. It is interesting to compare this number of benign tumors with the malignant neoplasms of the larynx seen during the same period; approximately 1,100 malignant tumors were seen, as compared with the 722 benign lesions. Because this paper is extremely long, we cannot discuss the details herein. It was shown that the great majority of benign tumors of the larynx arise from an inflammatory basis. Fifty-four and five-tenths per cent of these 722 benign tumors were not true neoplasms. The remaining 45.5 per cent were listed as true neoplasms, although it was thought that many of the growths were the result of an inflammatory process. Although we stated that it is impossible to classify benign tumors of the larynx with complete accuracy, we have arranged benign tumors in the following

53. Blady, J. V.: A New Instrument for Irradiation of Tumors of the Nasopharynx with Radium or Radon, Am. J. Roentgenol. **40**:723-729 (Nov.) 1938.

54. Cappell, D. F.: The Pathology of Nasopharyngeal Tumours, J. Laryng. & Otol. **53**:558-580 (Sept.) 1938.

55. New, G. B., and Erich, J. B.: Benign Tumors of the Larynx: A Study of Seven Hundred and Twenty-Two Cases, Arch. Otolaryng. **28**:841-910 (Dec.) 1938.

classification: (*1*) true neoplasms, consisting of adenomas, papillomas, fibromas, neurofibromas, fibrolipomas, chondromas, osteochondromas, angiomas, myxomas and cysts, and (*2*) non-neoplastic tumors, most of which are inflammatory, xanthomas, amyloid tumors, epithelial hyperplasia and leukoplakia and prolapse of the ventricle. We stressed the importance of histologic examination of every benign tumor which is removed from the larynx, because of the fact that a few of them may be confused with malignant tumors. Most of these tumors, we stated, can be removed with suspension laryngoscopy, although a few can be satisfactorily removed only by thyrotomy.

Gutzmann [56] described a method of phoniatric treatment for multiple papillomas of the larynx; this procedure is adapted for postoperative treatment and for patients who refuse to undergo reoperation. The patient receives treatment twice a week with harmonic vibrations, together with instillations of 4 per cent iodex, a colloidal iodine-copper solution. Under such treatment, the author stated, the remains of the papillomas disappeared and the voice of the patient changed from aphonic to clear. It was recommended that the treatment be continued for some months and that often it would be advisable to stop the treatment for a few weeks. This is an interesting but not convincing article.

Harris [57] reviewed a case in which a laryngeal tumor was removed from a child in 1904 by laryngofissure. This growth was reported as being an angiomatous fibroma. Subsequently, much of the laryngeal cartilage was lost as the result of perichondritis, and an intubation tube was introduced to prevent cicatricial stenosis. In 1905 the child was seen again, and another growth was discovered in the larynx. A second laryngofissure was performed, and this time the growth was reported as being a papilloma. In 1936 the author saw the patient once more, and in spite of much scarring in the larynx, the voice was remarkably good. Harris commented on laryngeal methods used in the early years of the twentieth century and those of the present time. In this particular case, Harris stated the belief that the fibroma underwent papillomatous changes, since he remarked that the transformation of a fibroma into a papilloma is almost unheard of. It would seem likely, however, either that the two growths were not related to each other or that the pathologic diagnosis was incorrect concerning one or the other lesion.

According to Weinstein,[58] myxofibromas of the larynx are extremely rare. He reported 2 cases merely for purposes of recording. Both growths were removed under direct laryngoscopy.

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56. Gutzmann: Die phoniatrische Nachbehandlung mehrfach operierter multipler Papillome des Kehlkopfs, Ztschr. f. Hals-, Nasen- u. Ohrenh. **44**:84-85, 1938.

57. Harris, T. J.: Final Results of Fibroma of Larynx in a Child of Three Years: Tracheotomy, Removal by Laryngofissure, Prolonged Intubation, Tr. Am. Laryng. A. **60**:104-107, 1938.

58. Weinstein, S.: Myxofibroma of the Larynx: Report of Two Cases, Laryngoscope **48**:693-696 (Sept.) 1938.

Tobeck [59] reported 2 cases in which chondromas of the larynx were successfully removed by surgical operation. Chondromas situated inside the larynx and those situated outside are distinguished. Important agents in arriving at the correct diagnosis and in determining the extent of the lesion are the roentgen rays.

Of extreme rarity in the larynx are 2 tumors reported by Klose.[60] The first was a congenital cyst which afflicted a 9 year old girl. It was wholly removed. The author remarked that congenital cysts are most frequently found in the regions of the aryepiglottic folds or in the ventricles of Morgagni. Retention cysts are much more frequent in occurrence. The second tumor reported by Klose was a fibrolipoma attached to the right vallecula epiglottica by a narrow pedicle. It was removed with a nasal snare; some difficulty was encountered because the stalk of the tumor was extremely fibrous.

Lallemant, Delarue and Leroux-Robert [61] presented a discussion of the subject of polyps of the larynx. The authors deplored the loose use of the term as it had been employed in the past and made a great effort to impress the reader with the idea that a polyp of the larynx is a definite entity, pathologically. Polyps of the larynx must be distinguished from angiomas, lipomas, adenomas, myxomas, chondromas, papillomas and all those tumors which by error are described as "polyps of the larynx." Histologically polyps are classified as (*1*) exudative, (*2*) degenerative and (*3*) organized. These are discussed and described individually by the authors. In the exudative group are pseudomyxomas, pseudocysts, angiomatous polyps and hemorrhagic polyps. The degenerative group includes fibrinoid, hyaline and amyloid polyps. Polyps are not tumors; they are a response to an inflammatory process in the submucosa of the larynx which may regress or proceed to organization according to the intensity of the activating factors. The inflammatory processes are not specific; that is, they are not such entities as tuberculosis or syphilis. A complete bibliography of ninety-seven articles, was presented.

Piquet and Boury [62] expressed the opinion that malignant change in polyps of the larynx is more common than is generally appreciated. Moreover, they stated, the majority of benign laryngeal tumors that have degenerated into a malignant growth have been papillomas.

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59. Tobeck, A.: Die Chondrome des Kehlkopfes, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **146**:79-98, 1939.

60. Klose, W.: Zwei Fälle von seltneren Kehlkopftumoren, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **145**:154-158, 1938.

61. Lallemant, M.; Delarue, J., and Leroux-Robert, J.: Les polypes du larynx (étude anatomo-clinique), Ann. d'oto-laryng., January 1939, pp. 9-30.

62. Piquet and Boury: La dégénérescence maligne des polypes du larynx, Ann. d'oto-laryng., March 1939, pp. 225-242.

Although such a change may be spontaneous, they stated the belief that the majority of such changes occur after performance of a laryngeal surgical procedure or after roentgen therapy. The fact which the authors wished to make clear is that a laryngeal polyp may precede a cancer. As a matter of fact, a polyp is really a clinical expression of changes in the mucosa of the larynx which may later pass on to form cancer. Under certain conditions and when certain causes, still indefinite, are operative, the mucosa of the larynx exhibits anatomic changes, and what is called a "precancerous condition" is formed. The frequency of degenerative changes varies with the many histologic types; that is, they are rare in flat polyps and frequent in the papillomatous type of polyp. The latter, when seen in the aged, is a cancer in the making. When degenerative changes occur in a patient more than 20 years old, leukoplakia and horny papillomas often undergo malignant change. The treatment of malignant polyps recommended by the authors varies according to the case. If the surgeon is dealing with a flat polyp which has a high degree of hyperkeratosis, it is sufficient, after removal of the tumor, to keep the patient under regular surveillance. But in the case of a papilloma of the larynx in aged subjects, such conservative attention is insufficient. The surgeon should resort to hemilaryngectomy or even total laryngectomy.

Thomson [63] presented an interesting account of the history and progress of treatment of carcinoma of the larynx. The factors which have contributed to progress in the treatment of laryngeal cancers are: the invention of the laryngoscope, the rapid advance of physiologic and chemical knowledge, the discovery of cocaine and epinephrine, perfection of electric illumination, the discovery of roentgen rays, better methods of arresting hemorrhage and the advent of listerian surgery. Thomson offered an interesting historical outline of the development of laryngofissure and laryngectomy and presented tables of operative deaths and of long time cures of cancer of the larynx achieved by various methods during approximately sixty years.

A discussion of benign and malignant tumors of the larynx in the order of their importance was given by Figi.[64] In reference to laryngeal carcinoma he stressed the importance of performing biopsy even though the diagnosis appears to be obvious on clinical examination. In general, he advocated radical operation rather than irradiation for the treatment of laryngeal carcinoma. Lesions situated in the supraglottic portion of the larynx, especially those about the epiglottis and aryepiglottic folds, usually are an inactive type and can be treated satisfactorily by electro-

63. Thomson, St. C.: History of Cancer of the Larynx, J. Laryng. & Otol. **54**:61-87 (Feb.) 1939.

64. Figi, F. A.: Tumors of the Larynx, Minnesota Med. **21**:553-558 (Aug.) 1938.

coagulation of the lesions under suspension laryngoscopy. Pharyngotomy is at times necessary to gain adequate exposure. Figi recommended thyrotomy for intrinsic cancer in which the tumor is inactive and not fixed; if the tumor is active, it must be in an early stage and well localized if thyrotomy is to be done satisfactorily. For more active lesions or for lesions which involve both sides of the larynx and extend to the arytenoid cartilage on one or both sides, laryngectomy is indicated. Figi mentioned 73 patients who were subjected to laryngectomy and who were later traced. Forty-one (56.1 per cent) of them were found to be alive and well after five years. He stated that radium and roentgen rays may be used as supplementary measures but rarely should be used to the exclusion of other measures, if the laryngeal lesion can be removed surgically.

The differential diagnosis of intrinsic cancer of the larynx was described by Negus.[65] Diseases of the larynx which are commonly confused with malignant conditions are chronic, diffuse, simple laryngitis, hypertrophic laryngitis, syphilitic infiltration, leukoplakia, tuberculous laryngitis and simple neoplasms, such as granulomas. He described the diagnosis of these conditions and stressed the fact that a malignant condition may also be present or develop in some of these laryngeal conditions. The importance of histologic examination of all tumors of the larynx, for the possibility of determining the nature of the lesions and, if the lesions are malignant, for the possibility of learning the grade of malignancy, was stressed. However, the author pointed out that the pathologic report may be misleading at times because the sections obtained have not included a portion of the tumor; that is, the surgeon may not have gone deep enough to include the cancerous region. If the clinical appearance of the laryngeal tumor strongly suggests carcinoma, Negus recommended that the condition be treated as a malignant disease in spite of a pathologic report denying the presence of cancer.

Apparently, Canuyt and Gunsett[66] have done considerable work on the use of tomography in the examination of the larynx and the diagnosis of cancer of the larynx. In their article there are but a few cases presented out of a great number. Those chosen were selected because they were more demonstrative. The conclusions that can be derived from this work may be summarized as follows: Tomography has given remarkable results in the localization of pulmonary lesions as well as of foreign bodies. Interesting observations can be made in similar pictures of the larynx. This method of roentgenologic procedure permits

65. Negus, V. E.: Differential Diagnosis of Intrinsic Carcinoma of the Larynx, Arch. Otolaryng. **29**:223-234 (Feb.) 1939.

66. Canuyt, G., and Gunsett: La tomographie du larynx et le cancer du larynx; importance de la méthode des coupes radiographiques, Ann. d'oto-laryng, May 1938, pp. 381-398.

the surgeon to compare the right side of the larynx with the left or to select any desired plane of the larynx and visualize it roentgenologically. When they applied this method of roentgenologic study to diseases of the larynx, excellent results were obtained by the authors, especially in the exact localization of lesions. Tomography repeatedly reveals accurately the site and extension of a neoplasm of the vocal cords and therefore is a great aid in selecting the operative approach of choice in such an instance.

Jackson and Jackson [67] have reviewed 3 special cases of carcinoma of the larynx in an attempt to answer the following questions: 1. Are physicians justified in limiting the use of irradiation to cases in which operation is contraindicated? 2. Where shall the line be drawn between cases in which operation should be done and cases in which irradiation should be used? 3. What is the effect of the degree of malignancy on the choice between operation and irradiation? 4. Is it justifiable to do laryngectomy for a small growth in the anterior commissure even if the degree of malignancy is high? 5. In view of the later improvements in the technic of irradiation, is the surgeon not justified in doing fewer laryngectomies?

The answers are as follows: 1. Although the results of irradiation have been remarkable in the last few years, the authors stated the belief that laryngofissure should be preferred to irradiation in instances of early intrinsic cancer; they also stated that there are cases in which total laryngectomy may be regarded as the treatment of choice. 2. For small, early lesions situated on the top of the epiglottis, surgical treatment by endoscopic methods is indicated. For all larger growths irradiation is recommended. Laryngofissure is recommended for intrinsic cancers of the larynx, that is, for growths the size and situation of which are amenable to this type of treatment; however, if the patient's life expectancy is shortened by some associated disease irradiation is preferred. As to laryngectomies, the authors stated that the number of patients treated by laryngectomy is decreasing in proportion to the number treated with irradiation, and they decline to perform laryngectomy for patients who are poor surgical risks from a general standpoint, preferring irradiation in these cases. 3. They recommended (*a*) laryngofissure for every small early growth in the intrinsic region in a patient free from general organic disease, regardless of the degree of malignancy, (*b*) laryngectomy for an advanced but still intrinsic growth of grade 1 or 2 in a patient free from organic disease but irradiation for cancer of grade 3 or 4 and (*c*) irradiation for an intrinsic growth with glandular metastases. 4. The authors have found it unnecessary to do laryngectomy for a small growth in the anterior commissure. 5. They stated the belief

67. Jackson, C., and Jackson, C. L.: Cancer of the Larynx, J. A. M. A. **111**:1986-1993 (Nov. 26) 1938.

that the future probably will see a progressive decrease in the relative number of laryngectomies performed as compared with the number of patients treated by irradiation.

As described by Imperatori,[68] the indications for treating malignant diseases of the larynx by surgical methods or irradiation are obtained from the individual history of the patient, laryngeal inspection, biopsy, histologic grading, fluoroscopic examination of the larynx and roentgenographic examination. The indications for thyrotomy (laryngofissure) are: (*1*) unilateral cordal growth situated anterior to the vocal process and involving little, if any, of the anterior commissure, (*2*) grade 1 or 2 squamous cell carcinoma, (*3*) slight or no loss of mobility of the cord and (*4*) absence of adenopathy. The indications for laryngectomy are: (*1*) an intrinsic lesion of such size, situation and involvement of the structures (but not associated with palpable lymph nodes) that the operation of thyrotomy would be insufficient; (*2*) bilateral, anteriorly situated lesions in certain instances and all posterior lesions; (*3*) previous unsuccessful treatment with irradiation, accompanied by perichondritis and necrosis of the framework of the larynx, and (*4*) extrinsic lesions of the larynx. Irradiation is indicated in the presence of: (*1*) a basal cell growth, (*2*) an epithelioma of a noninfiltrated cord, (*3*) a growth in the epiglottis or the glossoepiglottic folds and (*4*) an inoperable extrinsic growth, as evidenced by enlarged lymph nodes and also postcricoid growths. Irradiation also may be used after thyrotomy or laryngectomy, and the method of choice is that of Coutard.

Kramer [69] presented a statistical study of 59 patients who had cancer of the larynx and who had come under his supervision and care. He analyzed these cases from the standpoint of histologic aspects of the lesions, extent of the disease and situation or site of origin. Sixty-four per cent of the patients treated by irradiation or surgical intervention had been free of disease for at least one year at the time Kramer wrote. Sixty-one per cent had been free of disease at least three years, and 58 per cent had been well five years or more when he wrote. Thirty-one of these 59 patients were treated primarily with irradiation; 58 per cent of these had been free of disease one year or more at the time of reporting. Of 7 patients treated by irradiation in conjunction with surgical methods 5 had been free of disease one or more years at the time of writing. Of 12 patients treated by laryngectomy, 50 per cent were free of disease at the time Kramer wrote. Ten (83 per cent) of 12 patients treated by thyrotomy were free of disease. Kramer stated the belief that highly differentiated squamous cell carcinomas are better treated by surgical

68. Imperatori, C. J.: Indications for Different Types of Treatment of Malignant Diseases of the Larynx, Arch. Otolaryng. **28**:585-588 (Oct.) 1938.

69. Kramer, R.: Treatment of Laryngeal Carcinoma, Laryngoscope **48**:645-655 (Sept.) 1938.

methods, unless the extent or site of origin of the lesion favors the use of roentgen therapy. Surgical methods and radiotherapy are approximately of equal value for patients who have freely movable vocal cords, according to Kramer, but he favored thyrotomy or partial laryngectomy in such instances because the convalescence of the patient is thereby rendered shorter and more comfortable. Extrinsic laryngeal cancers, he stated, are better treated by roentgen therapy. Fixation of the cords or intrinsic laryngeal cancers are better treated by surgical methods. Subglottic lesions respond better to surgical intervention than to radiotherapy. In cases of doubt as to the results of operation he recommended roentgen therapy as soon as the patient's wound has healed.

In reference to cancer of the laryngopharynx, Orton [70] described the frequency, incidence, prognosis, classification, symptoms, diagnosis and treatment of such lesions. In his opinion, the best prognosis for cancers of the epiglottis is achieved by operative procedures, whereas the prognosis for lateral and posterior pharyngeal types is good if these lesions are seen early. Growths of the piriform sinus and in the postcricoid region have the poorest prognosis, although, he stated, if they are seen at an early stage surgical intervention may be valuable. For removal of these growths he employed Trotter's operation, which includes the following features: (*1*) suture of the sternocleidomastoid muscle to the prevertebral muscle, (*2*) removal of the thyroid cartilage and the cornu of the hyoid bone before the pharynx is opened, (*3*) immediate closure of the pharyngeal wall and (*4*) combination of this operation with a plastic procedure when necessary.

Colledge [71] considered the problem of carcinoma of the laryngopharynx and larynx with particular reference to surgical therapy. In cases of epithelioma of the oral portion of the pharynx, he recommended diathermy for the local lesion and dissection of the glands. If dissection of the glands is necessary, he stated that it should precede diathermic operation by ten or fourteen days. For more extensive growths situated in the oral portion of the pharynx which invade the base of the tongue, diathermy alone is not applicable; electrocoagulation must be combined with a rather mutilating operation. However, if such growths are grade 4 epitheliomas, he recommended the use of irradiation. Malignant tumors of the hypopharynx involving the epiglottis, the aryepiglottic fold or the postcricoid region may be treated by lateral pharyngostomy. For tumors of this type which are in a more advanced stage and for those which involve the piriform fossa, pharyngeal laryngotomy is required. Colledge stated that until recent years results obtained by

70. Orton, H. B.: Cancer of Laryngopharynx, Arch. Otolaryng. **28**:344-354 (Sept.) 1938.

71. Colledge, L.: Treatment of Carcinoma in the Pharynx and Larynx and Its Results, Brit. M. J. **2**:167-168 (July 23) 1938.

treatment with roentgen rays or radium of tumors situated in the lower part of the pharynx were almost negligible. For malignant tumors of the larynx he recommended laryngofissure or total laryngectomy. He added that for malignant laryngeal tumors irradiation has had most success but said that it has yet to be shown that irradiation can produce a large percentage of good results. He recommended the use of radium beams rather than of radium needles in the treatment of malignant lesions of the larynx.

One of us (New [72]) discussed the treatment of carcinoma of the larynx as carried out at the Mayo Clinic. A general discussion as to the diagnosis of carcinoma of the larynx was presented, and the value of suspension laryngoscopy, both for better visualization of the growth and for obtaining accurate results at biopsy of the lesions, was stressed. Treatment is based on the evaluation of various methods of therapy, both by surgical methods and by irradiation, and on the application of these methods to the individual case. Carcinoma of the larynx is divided into three groups: (*1*) supraglottic growths, (*2*) intralaryngeal growths, including the subglottic, and (*3*) laryngopharyngeal growths, arising in the piriform sinus or in the postcricoid region. Supraglottic growths and tumors of the epiglottis usually are of low grade malignancy, whereas those situated at the base of the tongue are of high grade. If the lesion is limited to the epiglottis, removal by means of surgical diathermy under suspension laryngoscopy produces excellent results. Even when the growth involves the base of the tongue, it may be removed thoroughly with diathermy and radon seeds may be inserted into the involved region. In supraglottic tumors in which the aryepiglottic fold is involved, pharyngotomy through the thyrohyoid membrane, or lateral pharyngotomy, is the treatment of choice. Carcinomas of the epiglottis which are infiltrating lesions should not be removed under suspension laryngoscopy; irradiation is indicated in such cases. It was stated that intralaryngeal growths, when limited to the interior of the larynx, may be removed by thyrotomy or laryngotomy. Surgical diathermy is used in all cases in which thyrotomy is employed. The lesion which is seen early and in which there is no fixation of the cord is widely removed, and the base is destroyed by means of diathermy, but when the lesion is more advanced, with some limitation of movement of the anterior two thirds of the vocal cord, the growth is removed with the cartilage and the base is destroyed by means of diathermy. This really amounts to hemilaryngectomy. In cases of a growth involving the anterior commissure, the surgeon should consider the possibility of the lesion's extending through the cricothyroid membrane. In these cases, if wide removal is done, including removing the anterior portion of the thyroid cartilage, the patient

72. New, G. B.: Surgical Treatment of Carcinoma of the Larynx, Surg., Gynec. & Obst. **68**:462-466 (Feb.) 1939.

may still have a patent airway and an acceptable voice. Laryngectomy is done in all cases of intrinsic cancer of the larynx in which conservative removal would not permit of a sufficient margin of safety. The technic of performing laryngectomy was described. In this operation a tongue-like flap of mucous membrane is dissected free from the posterior wall of the cricoid cartilage, being left attached to the tracheal mucous membrane. This flap greatly facilitates closure of the trachea. Drawings and illustrations were presented in the paper to show the technic of closure of the pharyngeal wall and the overlying skin. Block dissection of the lymph nodes of the neck is not carried out as a routine measure when laryngectomy is performed unless the nodes are involved. Since most postcricoid growths are of grade 4 malignancy, the lymph nodes are usually found to be involved at the time of the first examination. Much can be accomplished in these cases by irradiation. Surgical intervention according to Trotter's method of transhyoid pharyngotomy is the treatment of choice if there is no involvement of lymph nodes and if the patient is otherwise a good surgical risk.

Hoover and Richter [73] stressed the importance of early diagnosis of intrinsic cancer of the larynx and the importance of performing biopsy. The authors stated that cure had been obtained by laryngofissure in more than 80 per cent of selected cases of intrinsic cancer of the larynx and that cure had been effected for 66 per cent of patients selected for laryngectomy.

Although in Kernan's [74] opinion roentgen therapy in particular has rapidly improved in the past few years and although many patients have been definitely cured by roentgen therapy, he said that laryngeal cancers which are operable should be treated by surgical methods. He emphasized the fact that it is not yet known how durable the cure of these patients treated by roentgen rays will prove to be, whereas the outcome of surgical procedures is rather well established.

In a detailed article on cancer of the larynx, Orton [75] showed his results of operation in 102 cases of cancer of the larynx in which the patients were treated by laryngectomy and laryngofissure. In this article there are some excellent photomicrographs and photographs. Orton presented a discussion of the causation, pathologic aspect, symptoms, physical signs and diagnosis of this condition. Seventy-five per cent of his patients had squamous cell epithelioma, 3 per cent had basal cell carcinomas, 20 per cent had papillary carcinomas and 2 per cent had

73. Hoover, W. B., and Richter, H. J.: Intrinsic Carcinoma of the Larynx, S. Clin. North America **18**:605-608 (June) 1938.

74. Kernan, J. D.: A Critique of the Treatment of Laryngeal Cancer, Laryngoscope **48**:295-301 (May) 1938.

75. Orton, H. B.: Cancer of the Larynx: Immediate and Ultimate Results of Operation in One Hundred and Two Cases, Arch. Otolaryng. **28**:153-192 (Aug.) 1938.

adenocarcinomas. Although intrinsic cancers are amenable to laryngofissure, Orton stated the belief that subglottic cancers should be treated by laryngectomy, because recurrences are so common after laryngofissure in such cases. For extrinsic cancers, in spite of the fact that they metastasize early, treatment by radical operation is indicated if the lesions are diagnosed early. The author described a one stage laryngectomy in which a T-shaped incision is employed and in which the hyoid bone is removed to allow for better closure. Of 94 of Orton's patients treated by laryngectomy, the operation was successful for 66 (70 per cent), and of 8 patients treated by laryngofissure the procedure was successful for 6 (75 per cent).

The history and technic of laryngofissure were considered by Myerson.[76] Myerson recommended cocainization of the larynx and wrote that he does not employ a general anesthetic agent. He stated the belief that performance of tracheotomy is unnecessary and that adequate exposure can be obtained without extensive incision of the thyrohyoid membrane and without cutting through the cricothyroid membrane. He wrote that he removes the lesion and the associated cartilage, if it is involved, by excision or by means of a special type of punch. No electrocoagulation is employed. Laryngofissure is recommended for cancers localized to one side of the larynx, not involving the arytenoid region, or the commissure and not extending above the ventricular band or below the level of the cricoid rim. No cases were presented.

In instances of carcinoma of the larynx surgical intervention rather than irradiation was preferred by Crowe and Broyles.[77] They stated that irradiation should be employed only for inoperable lesions or to supplement operative removal. When the growth had invaded the cartilage, muscles or glands, they used irradiation therapy entirely. All intrinsic malignant growths were removed by either laryngofissure or total laryngectomy. Laryngectomy was chosen when the anterior commissure was involved or when the vocal cord was fixed by the lesion. Crowe and Broyles presented excellent drawings and illustrations of the technic which they used in removing the larynx. It is interesting to note that they stated that if the operation is properly done, there is no loss of blood and no shock and the patient is enabled to sit up or get out of bed on the second postoperative day. The feeding tube is removed on the third day, and the patient is able to leave the hospital two weeks later. The type of laryngectomy which Crowe and Broyles used is done in one stage.

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76. Myerson, M. C.: Technic of Laryngofissure for Cancer of the Larynx, Arch. Otolaryng. **29**:662-673 (April) 1939.

77. Crowe, S. J., and Broyles, E. N.: Carcinoma of the Larynx and Total Laryngectomy, Ann. Otol., Rhin. & Laryng. **47**:875-890 (Dec.) 1938.

Many excellent illustrations were employed in a detailed article by Zinn [78] on the technic of one stage laryngectomy. Postoperative treatment and possible complications, such as hemorrhage, pharyngeal fistula and bronchial infections, were discussed. Also, reference was made to the problem of teaching the patient to speak again. A series of 25 cases in which total laryngectomy was performed for carcinoma of the larynx was presented. Fifteen of the patients were living and well at the time that this paper was written. In the author's technic for laryngectomy, according to this article, he used a T-shaped incision; for anesthesia he expressed a preference for nitrogen monoxide and ether administered by the drip method after the administration of tribromethyl alcohol in amylene hydrate (avertin with amylene hydrate). After the trachea has been cut across, a special tube is used to maintain the state of anesthesia. This tube has two branches, one for the administration of the anesthetic and the other for the administration of oxygen if it is needed.

Hofer [79] summed up his experiences with partial laryngectomy in the following manner: (1) The malignant tumor must be situated inside the larynx, must be confined to one side and must not pass the midline, either anteriorly or posteriorly; (2) laryngectomy is to be done only when the posterior wall of the cricoid cartilage can be saved on the diseased side, and (3) if the anterior ring portion of the cricoid cartilage must be removed, it is important that the posterior wall of the cricoid be kept intact. The term "laryngectomy" in the anatomic sense means complete removal of the thyroid and cricoid cartilages. Hofer stated that total removal of the larynx cannot be done without lasting disturbance in swallowing and in respiration. He added that if the surgeon will follow the aforementioned rules, he will never be unpleasantly surprised by disturbances in the breathing or swallowing of the patient.

Thirty-two patients who had carcinoma of the larynx were treated by Harris and Klemperer [80] with roentgen rays, according to the principles of Coutard. Material obtained for biopsy was studied histologically to determine a criterion for pathologic differentiation of radiosensitive and radioresistant neoplasms. Tables were presented to reveal the results of treatment of the 32 patients, according to the situation of the tumors, frequency of mitosis and the degree of cellular anaplasia present. However, no clearcut criterion could be established.

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78. Zinn, W. F.: Laryngectomy—One Stage, Ann. Otol., Rhin. & Laryng. **47**:453-472 (June) 1938.

79. Hofer, G.: Zur Anzeigestellung bei der halbseitigen Exstirpation des Kehlkopfes, Wien. klin. Wchnschr. **51**:1024-1026 (Sept. 26) 1938.

80. Harris, W., and Klemperer, P.: Pathologic Differentiation Between Radiosensitive and Non-Radiosensitive Malignant Neoplasms of the Larynx, Arch. Otolaryng. **28**:355-363 (Sept.) 1938.

It was concluded that for protracted roentgen therapy the histologic structure is of minor importance in determining the radioresistance of laryngeal carcinomas.

Coutard [81] described the effects of quantitative and qualitative roentgen therapy on differentiated and undifferentiated cancer cells. In undifferentiated cells, he stated that the effects produced by the total dose of roentgen therapy are the same as the effects produced by the daily doses. In differentiated cells, however, irradiation is inefficacious because the cells have a fleeting transitional radiosensitivity. In differentiated cancers, after fifteen to twenty days of efficacious irradiation the effects suddenly cease and the cells show no further modification. After this, additional irradiation is of no value, accentuates the pain and edema, impairs the general condition of the patient and renders incurability more absolute. In Coutard's tables showing the results of roentgen therapy of patients with cancer of the larynx, the average for five year survivals from 1921 to 1932 was 27 per cent.

In another article Coutard [82] compared irradiation therapy for laryngeal cancers of undifferentiated cells with similar therapy for laryngeal cancers of differentiated cells. Cancers composed of undifferentiated cells, which have a tendency toward early and widespread dissemination, are treated successfully and easily by roentgen rays. Because of their tendency to dissemination, these cancers are not biologically operable, although they may be technically operable. The treatment of cancers composed of differentiated cells is in the domain of surgery, and usually such cancers are not curable by irradiation. Treatment of inoperable cancers by roentgen rays was divided into (*1*) preparatory treatment, (*2*) daily and continuous treatment and (*3*) periodic treatment. Preparatory treatment has increased the number of five year survivals, but insufficient daily doses administered during the last three days of treatment sometimes has provoked recurrence about six years after irradiation. This seems to be the critical period, and death of the patient occurs in one, two or three years. If the patient survives this critical period, he will still be free from the disease after fifteen years. Coutard described the possibility of utilizing external variations in the daily doses; that is, small doses in the preparatory treatment and high doses during the last days of treatment. This procedure is encouraging for the future, Coutard wrote.

In a general discussion on cancer of the larynx, Scott and Moore [83] described the intrinsic and extrinsic forms of the disease and the technic

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81. Coutard, H.: Cancer of the Larynx: Results of Roentgentherapy After Five and Ten Years of Control, Am. J. Roentgenol. **40**:509-516 (Oct.) 1938.

82. Coutard, H.: X-Ray Treatment of Inoperable Carcinoma of the Larynx, Surg., Gynec. & Obst. **68**:467-471 (Feb., no. 2A) 1939.

83. Scott, W. G., and Moore, S.: The Roentgen Treatment of Carcinoma of the Larynx and Hypopharynx, South. M. J. **32**:144-150 (Feb.) 1939.

of the Coutard treatment. Their conclusions are: 1. The treatment of intrinsic cancer limited to the cord appears to be laryngofissure at present. 2. Irradiation will probably become the treatment of choice in the future. 3. Preoperative and postoperative roentgen ray treatment for both intrinsic and extrinsic lesions is of definite value in increasing the percentage of five year cures obtained by surgical methods. 4. Roentgen therapy when successful leads to a better rehabilitation of the functions of the larynx and hypopharynx.

Hamblen-Thomas [84] emphasized the following points in the treatment of carcinoma of the pharynx and larynx: (1) operation should be performed when possible, and (2) radium has its particular uses, and so has roentgen ray treatment. Hamblen-Thomas stated that large and definitely radiosensitive tumors are better treated by irradiation. Intrinsic carcinomas of the larynx, if not spread posteriorly to the arytenoid cartilages or anteriorly to the epiglottis, are particularly susceptible to irradiation. However, when glands are involved in these instances, results of treatment are not good. Hamblen-Thomas wrote that his own treatment is limited to the use of radium needles or radon seeds and that he obtains better results with needles than with seeds. He advocated the use of roentgen rays as the best treatment for rapidly growing malignant tumors in these regions and as the only treatment for extensive growths with serious involvement of glands.

Cancers confined to the vocal cords were treated by Müller [85] with radium plaques after performance of thyrotomy. More extensive carcinomas and carcinomas of the hypopharynx were treated with roentgen rays. Three year cures and five year cures were reported to have been achieved by the combined use of these two treatments; after three years 70.5 per cent of his patients were alive; after five years, 53.8 per cent of his patients were alive. These observations concern only 61 patients who had carcinoma of the inner portion of the larynx. The questions of diagnosis, biopsy and grade of malignancy were not considered.

Because of the rarity of lymphosarcoma of the larynx, Arons [86] reported a case of this type of growth in which the lesion afflicted a man aged 60. Two courses of roentgen therapy were given; they greatly improved the internal appearance of the larynx and the general condition of the patient. However, the patient died one and a half years after the initial treatment. In the author's opinion fractional roentgen therapy

84. Hamblen-Thomas, C.: Treatment of Carcinoma in the Pharynx and Larynx by Irradiation, Brit. M. J. **2**:447-448 (Aug. 27) 1938.

85. Müller, R.: Ergebnisse der Röntgen- und Radiumbestrahlung von Larynx- und Hypopharynx-Karzinomen, Strahlentherapie **63**:483-495, 1938.

86. Arons, I.: Sarcoma of the Larynx, Laryngoscope **48**:745-748 (Oct.) 1938.

was indicated in these cases; such treatment at least prolongs the patient's life under comparatively comfortable circumstances.

TUMORS OF THE TRACHEA

Jackson and Jackson[87] presented a general discussion of benign tumors of the tracheobronchial tree. The authors considered inflammation to be an etiologic factor in some of these tumors and inflammatory obstruction to be a factor in the causation of retention cysts. A specific infection accounts for the development of some granulomas, such as those referable to tuberculosis, syphilis, spirochetosis, blastomycosis and actinomycosis. Jackson and Jackson have seen a number of hematomas of the bronchi and have attributed them to capillary rupture caused by coughing. However, they stated the belief that trauma is a lesser causative factor in the tracheobronchial tree than it is in the larynx. In their experience the following benign tumors have been encountered: angioma, hematoma, adenoma, myoma, myxoma, papilloma, fibroma, fibrolipoma, lymphangioma, lymphadenoma, lipoma, ecchondroma, osteoma, chondro-osteoma, retention cyst, amyloid tumor, aberrant tumor of the thyroid gland, specific granuloma and nonspecific granuloma. One peculiarity, they stated, of benign growths in the tracheobronchial tree is that, although they are small, they set up diffuse destructive secondary changes in the lung out of all proportion to their size. Jackson and Jackson have discovered that such a tumor usually is one of three types, the three being mechanically similar to the valves in an air pump, namely, stop valve, check valve and bipass valve. That type which has a stop valve action causes complete occlusion, resulting in atelectasis. The type which has a check valve action functions in such a manner as to check the inflow or outflow of air. In the lungs, if the check valve type of mechanism is set against outflow of air, emphysema is produced in the distal region. If it is set against inflow, atelectasis develops. The authors discussed the symptomatology, diagnosis and treatment of tracheobronchial tumors. In addition, peribronchial compressive growths which may require external surgical or roentgen ray therapy are discussed together with endobronchial benign growths which require bronchoscopic removal. They stated that the most important contraindications to bronchoscopic removal are a strongly positive reaction to a serologic test and high, irreducible hypertension or any organic disease which lessens the patient's life expectancy. In their opinion, almost all benign endobronchial tumors can be removed bronchoscopically, and the prognosis as to life in such cases is good. Recurrence is a possibility, especially in cases of lymphoma and papilloma.

87. Jackson, C., and Jackson, C. L.: Benign Tumors and Tumor-Like Conditions in the Tracheobronchial Tree, Am. J. Surg. **42**:275-281 (Oct.) 1938.

Gerlings and Roegholt [88] reported an instance of mixed tumor of the trachea, a rare condition. A woman aged 50 complained of difficulty in breathing and of the occurrence of severe choking spells. On examination a large semiglobular, smooth tumor was discovered in the upper part of the trachea, arising from the posterior wall. This was removed by external operation through the neck, in which the anterior wall of the trachea was incised. On removal, the tumor was found to be a mixed tumor similar to those occurring in the salivary glands: The authors discussed two theories of possible origin of this tumor. 1. Since the parotid gland develops from the third branchial arch and since the trachea develops behind the branchial clefts and near the third branchial arch, they suggested that a fragment of the parotid gland might be displaced a little farther backward to give rise to a tumor of the parotid type in the trachea. 2. Since it has been shown that the glands of the trachea are of the tuboacinous type and are identical morphologically with the mucoserous cells of the salivary gland, the tumor may have arisen from the tracheal glands, since these tracheal glands are found on the posterior aspect of the trachea between the ends of the cartilaginous rings.

Another mixed tumor of the trachea, in a man aged 69, was reported by Howarth.[89] This tumor was situated just below the vocal cords and almost filled the upper part of the trachea. Preliminary tracheotomy was done, but because of a series of circumstances the tumor was not removed until two years later. During this time the growth had not changed in size. The growth was removed through an external operation on the neck in which the trachea was opened anteriorly by a low incision. After the removal of the neoplasm, the patient had had no further difficulty at the time Howarth reported.

Two cases of hemangioma of the trachea were reported by Hofmann,[90] who claimed that these were the only ones described in the literature. Both patients were infants 2 months of age. Both tumors were visible just below the vocal cords, and both patients were operated on but died of bronchopneumonia.

Two cases of carcinoma of the trachea were reviewed by Cann.[91] In the first case, the tumor was situated midway between the larynx and the bifurcation of the trachea. In the second, the tumor was situated

88. Gerlings, P. G., and Roegholt, M. N.: Mixed Tumour of the Posterior Wall of the Trachea, J. Laryng. & Otol. **54**:194-196 (April) 1939.

89. Howarth, W.: Mixed Tumour of the Trachea, J. Laryng. & Otol. **54**:205-206 (April) 1939.

90. Hofmann, L.: Hämangiome der Trachea, Ztschr. f. Hals-, Nasen- u. Ohrenh. **44**:435-440, 1938.

91. Cann, R. J.: Basal Celled Carcinoma of the Trachea: A Report of Two Cases, J. Laryng. & Otol. **54**:197-204 (April) 1939.

in the upper third portion of the trachea. One of the 2 patients was treated by roentgen therapy of high voltage; the other, by teleradium. In both cases the tumor apparently disappeared after irradiation and the obstruction was relieved. The value of roentgenographic examination of the trachea after the introduction of radiopaque oil was demonstrated. In 1 case the tumor was clearly outlined by this procedure, and its exact situation was shown. The treatment and pathologic aspects of carcinoma of the trachea were discussed.

TUMORS OF THE ESOPHAGUS

A report of a case in which osteochondroma of the esophagus afflicted a man aged 74 was given by Reeves.[92] Such a tumor is extremely rare in the esophagus. It was pale, easily movable and nonulcerated and was situated on the posterior wall of the esophagus, about 20 cm. from the incisor teeth. It was removed with cutting forceps through an esophagoscope. At the time this report was made, six months had elapsed since the operation and the patient was perfectly well. This article contains good photomicrographs of the tumor. The author gave a short review of benign tumors of the esophagus.

Another tumor of extreme rarity is Bowen's disease of the esophagus. A case of this disease was reported by Cailliau and Leroux.[93] Clinically the tumor in question did not show any peculiarities that might suggest the true pathologic nature of the disease. Only an examination by biopsy made clear the diagnosis. The authors stated that on histologic examination a section of tissue affected by Bowen's disease shows isolated or small groups of enormous cells which have atypical and often vacuolated nuclei. Asymmetric mitotic figures may be seen occasionally; they may be multipolar. The intracellular chromatin is characteristic in arrangement. Several paragraphs of this article are devoted to the histologic structure and development of this type of lesion.

Watson[94] discussed the major causative factors in cancer of the esophagus in a series of 771 cases. Sixteen cases of multiple primary malignant neoplasms were selected from the aforementioned group. Double cancer occurred in 2.07 per cent of the cases. In 87.5 per cent of cases the second primary growth was situated in the upper air and food passages. Familial history of cancer was obtained in 37.5 per cent of the total cases. According to the author, multiple cancers tend

92. Reeves, E.: Osteochondroma of the Esophagus Removed Perorally with the Aid of a Speculum, Arch. Otolaryng. **29**:151-158 (Jan.) 1939.

93. Cailliau, F., and Leroux, L.: A propos d'une localisation oesophagienne de la maladie de Bowen, Ann. d'oto-laryng., November 1938, pp. 1076-1084.

94. Watson, W. L.: Cancer of the Esophagus: Some Etiological Considerations, Am. J. Roentgenol. **41**:420-424 (March) 1939.

to occur at a later age than do single cancers of the esophagus. He assumed that the same predisposing factors which cause intraoral cancer also play a part in causing cancer of the esophagus. Double cancers of the esophagus in a series of cases were of a higher degree of malignancy than were single cancers of the esophagus. Watson suggested that adequate measures to eliminate intraoral sepsis and dental troubles would not only reduce the incidence of intraoral cancer but would at the same time definitely reduce the number of patients in whom fatal neoplasm of the esophagus develops.

Hoover [95] reported observations on 62 patients who had carcinoma of the esophagus, 1 of whom was well after four years and seven months (at the time of Hoover's writing) and was cured by surgical treatment. He stated that carcinoma of the esophagus is the most frequent cause of dysphagia and deglutition, especially in persons more than 30 years of age. Roentgenologic examination and esophagoscopy are the only methods of value in making an early diagnosis, and an early diagnosis is the only means of improving the general results obtainable in carcinoma of the esophagus at present. The author stated that cures achieved by surgical methods are being reported in the literature and that some unusually good results are reported as having been gained by irradiation. In Hoover's 62 cases the lesions were about evenly distributed among the upper, middle and lower third portions of the esophagus.

An interesting case of carcinoma of the upper part of the esophagus was reviewed by Equen and Neuffer.[96] The symptoms of the patient, a man aged 58, were hoarseness and severe obstructive dyspnea. The growth was found to arise from the left posterolateral wall of the esophagus. Removal was accomplished by excision and resection of the tumor. Although postoperative mediastinal infection developed, it was controlled by the insertion of a catheter with suction through the operative incision down into the mediastinum. At the time that this article was written, three years had elapsed since the operation, and the patient was in good physical condition and without symptoms of recurrence of the cancer.

Guisez [97] cited two examples of the simultaneous presence of two cancerous growths in the esophagus. In the first instance, a man aged 54 had an epitheliomatous polyp in the upper third of the esophagus

95. Hoover, W. B.: Carcinoma of the Esophagus, S. Clin. North America **18**:633-641 (June) 1938.

96. Equen, M., and Neuffer, F.: Carcinoma of the Upper Esophagus, Laryngectomy and Resection; Postoperative Mediastinitis with Drainage; Three Year Cure, South. Surgeon **7**:411-414 (Oct.) 1938.

97. Guisez, J.: A propos de quelques formes anormales de cancers de l'oesophage, Bull. et mém. Soc. d. chir. de Paris **30**:476-484 (Dec. 2-16) 1938.

and basal cell epithelioma in the lower third. In the second case, the patient had not only a malignant lesion of the breast but also two coexisting cancers of the esophagus. On two occasions Guisez reported that patients who had cancer of the esophagus were treated with radium with complete relief of their symptoms, but later their symptoms recurred. The recurrence was found to be a new growth at a new site in the esophagus, the original site of the first tumor being found to be filled in with scar tissue. Guisez stated the belief that the two growths were independent in origin. In Guisez' paper is a description of a case in which the growth was found to extend over a region 16 cm. in length. Only after three extensive series of roentgen therapy was this large degenerating malpighian spinal cell epithelioma eradicated. Although the tumor was extensive in area, it had but little depth; consequently, limited infiltration into the surrounding tissue occurred. Another rather interesting case was described by Guisez; a definitely malignant lesion was discovered in the lower part of the esophagus, which responded well to fourteen roentgen ray treatments. On the eve of his dismissal the patient complained of rectal pains, and examination revealed the presence of cancer of the rectum. The author stated that the occurrence of secondary invasion of the esophagus by tumors of the bronchial tree or adjacent organs is rather uncommon but that, on the contrary, tumors originating in the esophagus and invading the surrounding organs are common. He presented reports of cases in which the primary growth was in the cheek and the secondary growth appeared in the esophagus and cases in which secondary cancer of the esophagus followed primary cancer of the breast. The secondary growth may appear many years after the primary growth has been removed and after an apparent cure has been effected. The site of the secondary growth in the esophagus was the middle third portion on the side corresponding to the side of the once affected breast. The last case reported concerned a cancer of the esophagus secondary to a cancer of the thyroid gland. The latter growth had been removed by operation four years previously.

Bade [98] presented several good roentgenograms of esophageal cancers.

Secondary malignant tumors often develop as implantations from primary mesopharyngeal and hypopharyngeal tumors, according to Zuppinger.[99] The author claimed that every seventh to eighth patient thus afflicted dies from secondary tumor of the esophagus. Since in his opinion the removal of a specimen for biopsy from the primary lesion

98. Bade, H.: Ein Beitrag zur Röntgendiagnostik der polypösen Ösophagustumoren, Röntgenpraxis **11**:174-178 (March) 1939.

99. Zuppinger, A.: Betrachtungen zu den sekundären Oesophagustumoren, Ztschr. f. Krebsforsch. **47**:413-420, 1938.

may be a factor in such implantations, he advised taking a specimen for biopsy with an electric snare.

Proske [100] observed that every sixth or seventh patient who had primary carcinoma of the hypopharynx and mesopharynx was afflicted by a secondary tumor in the esophagus. The most frequent sites are the middle and lower third portions of this structure. Most of the secondary carcinomas in the esophagus, the author stated, probably are implantations from the primary tumor.

Perkins [101] reported a case of metastatic obstruction of the esophagus in which the lesion occurred opposite the seventh thoracic vertebra. This lesion occurred in a woman aged 66 who had metastases about the right hilus secondary to Paget's disease of the left nipple. The left breast had been amputated seven years previously. Although gastrotomy had been done in this case, Perkins reported that roentgenologic treatment reduced the growth which was pressing on the esophagus and allowed the patient to take liquid and soft food through the mouth. By means of such roentgen therapy she was afforded almost a year more of life, without serious discomfort and with much relief from pain. According to the author, this case illustrated another step forward in the relief and treatment of metastatic cancer.

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100. Proske, E.: Untersuchungen über Ösophagusmetastasen, Strahlentherapie **64**:227-248, 1939.

101. Perkins, C. W.: Metastatic Obstruction of the Esophagus, Am. J. Roentgenol. **40**:737-740 (Nov.) 1938.

PLASTIC SURGERY, 1939

ROBERT H. IVY, M.D., D.D.S.
AND
HENRY A. MILLER, M.D., D.D.S.
PHILADELPHIA

Plastic and reconstructive surgery will be extended in its applications by the development of a skin grafting knife by Padgett for the precision cutting of large calibrated skin grafts and by the researches of O'Connor proving the feasibility of using stored refrigerated human cartilage as grafts.

The educational and professional requirements for designation as a specialist in this branch of surgery are being formulated by the American Board of Plastic Surgery. Recommendations concerning preliminary training have been made to the young physicians wishing advice as to the best way to approach the specialized studies. Examinations leading to certification by the board will be undertaken soon.

The literature in plastic surgery for 1939 has been divided according to the following subjects: (*1*) nature, scope and limitations of plastic surgical intervention; (*2*) results of clinical and laboratory research—general principles; (*3*) plastic operations on the face; (*4*) plastic operations on the nose; (*5*) plastic operations on the ears, and (*6*) plastic operations on the jaws and palate.

NATURE, SCOPE AND LIMITATIONS OF PLASTIC SURGICAL INTERVENTION

Updegraff [1] gives a most interesting account of the development of plastic surgery from its origin. Interested both as a member of the specialty and as a bibliophile who has acquired an enviable library of original books, the author has created an authoritative, instructive and fascinating article.

The status of plastic surgery in its earlier days is described by Beck,[2] with an appreciation of its present position. Its applications

1. Updegraff, H. L.: The Fall and Rise of Plastic Surgery, Am. J. Surg. **43**:637-656 (Feb.) 1939.

2. Beck, J. C.: Plastic and Reconstructive Surgery About the Face and Head: Then and Now, Illinois M. J. **76**:237-242 (Sept.) 1939.

were discussed by Matthews,[3] Palmer,[4] Malbec,[5] LaDage[6] and May.[7] May subdivides the problems evolved from a surgical point of view as being those either of closure or of reconstruction of malformations. Under the heading of closure cases can be classified as those in which the condition is amenable to simple mobilization and approximation, those in which shifting or rotation of tissues from the immediate neighborhood is required and those in which tissue must be brought in by means of flaps. The malformations considered were saddle nose deformity, deep retracted scars and deformities of the breast.

Facial deformities may produce not only social and economic disadvantages to the patient but psychic trauma as well. Malbec[8] and Guttman[9] have noted the diverse effects of rehabilitation by plastic operations.

Baker and Smith[10] have been interested in the psychic reaction of patients to various disfigurements, and they report the results of their psychiatric consultations with 312 patients, which were carried out during the patients' postoperative stay in the hospital. Persons seeking plastic repair of facial disfigurements were divisible into three main groups: group 1, the superior group, consisting of well adjusted persons; group 2, persons with recessive or inadequate personalities who retreat behind the "handicap" and unconsciously use it as a defense, and group 3, prepsychotic and psychotic persons with whom the facial abnormality is the material, the factical point of focus of a schizophrenic process. The patients were analyzed in respect to what reaction may be expected after operation on these various types of persons. The article clearly demonstrates the importance of evaluating the personality

3. Matthews, D. N.: Modern Applications of Plastic Surgery, M. Press **201**: 340-345 (April 5) 1939.

4. Palmer, D. H.: Problems in Plastic Surgery, Northwest Med. **38**:137-140 (April) 1939.

5. Malbec, E. F.: Cirugía plástica y estética, Semana méd. **1**:83-95 (Jan. 12) 1939.

6. LaDage, L. H.: Some Recent Developments in Plastic Surgery, J. Iowa M. Soc. **29**:609-611 (Dec.) 1939.

7. May, H.: Scope and Problems of Plastic Surgery, Pennsylvania M. J. **42**:1453-1458 (Sept.) 1939.

8. Malbec, E. F.: El estado mental y psíquico de algunos malformados, Semana méd. **1**:716-722 (March 30) 1939.

9. Guttman, M. R.: Modern Changes in Plastic and Reconstructive Surgery of the Face and Neck, Illinois M. J. **76**:349-351 (Oct.) 1939.

10. Baker, W. Y., and Smith, L. H.: Facial Disfigurement and Personality, J. A. M. A. **112**:301-304 (Jan. 28) 1939.

and emotional status of the patient and incidentally demonstrates to the reader the assistance that one trained in psychiatry can give to the surgeon.

Davis [11] seeks to correct some of the undue emphasis and erroneous impressions that have been absorbed by the average person because of articles in the newspapers and to separate fact from fancy in plastic surgery. Complications, with particular reference to rhinoplasty, are analyzed by Kopp [12] and include (*a*) infections, (*b*) structural and mechanical complications, (*c*) circulatory complications and (*d*) psychic complications.

Gerrie,[13] on the other hand, asserts that even for a patient of 72 years a plastic operation may be indicated and may contribute to his happiness and success, as described in a case report.

RESULTS OF CLINICAL AND LABORATORY RESEARCH—GENERAL PRINCIPLES OF PLASTIC SURGERY

Opinion varies widely among surgeons concerning the fate of various types of cartilaginous grafts after transplantation. Peer's [14] results show that grafts of dead cartilage buried nine and one-half months to two years showed progressive invasion by fibrous tissue and partial absorption. In contrast to these observations, autogenous grafts of rib cartilage showed no invasion or absorption over the same period.

O'Connor [15] reports his experience in 375 cases in which grafts of cartilage which had been stored in a refrigerator in a solution of 1 part aqueous merthiolate (1:1,000) and 4 parts of sterile physiologic solution of sodium chloride were used. The grafts were up to two years old when used. Postoperative results after five years were entirely satisfactory in all but 7 cases.

There has also been a great deal of speculation regarding the fate of buried skin grafts in human beings. The current impression is that such skin will undergo cystic degeneration. Peer's [16] investigations

11. Davis, A. D.: The Value and Limitations of Plastic Operative Procedures, M. Times, New York **67**:158-163 (April) 1939.

12. Kopp, M.: Complications of Rhinoplastic Surgery, J. Internat. Coll. Surgeons **1**:346-350 (Oct.) 1939.

13. Gerrie, J. W.: Plastic Surgery at Seventy-Two, Canad. M. A. J. **41**:548-549 (Dec.) 1939.

14. Peer, L. A.: The Fate of Living and Dead Cartilage Transplanted in Humans, Surg., Gynec. & Obst. **68**:603-610 (March) 1939.

15. O'Connor, G. B.: Merthiolate: A Tissue Preservative and Antiseptic, Am. J. Surg. **45**:563-565 (Sept.) 1939.

16. Peer, L. A.: Study of "Implantation Cysts": Fate of Buried Skin Grafts in Man, Arch. Surg. **39**:131-145 (July) 1939.

have shown that the epidermis of human grafts shows definite degenerative changes at one month and is entirely absent ten weeks after transplantation. Sebaceous glands in buried grafts of human skin disappear completely one month after transplantation. Hair follicles in buried skin were not found after five and one-half months and did not have a tendency to form cysts in earlier sections. Sweat glands persisted in all the buried grafts of human skin and did not lead to the formation of cysts.

The treatment of wounds requires meticulous attention to the removal of foreign material and bacteria by copious lavage and trimming of the wound to remove devitalized portions. In avulsions of small parts of the ear, nose and eyelids, Douglas [17] recommends that all but completely severed parts be sutured back into position and be watched expectantly. In 4 cases of skin avulsions elsewhere in the body Farmer [18] removed the avulsed skin completely, cleansed it of debris and all subcutaneous tissue and sutured it back successfully on the wound as a free skin graft.

War wounds of today, particularly of the face, are grossly contaminated by soil and foreign material owing to the type of explosives used, such as grenades. The need for untiring removal of foreign material and for copious lavage is now more important, according to Axhausen,[19] than in any previous war. The high incidence of associated injuries to the jaw has resulted in the training of oral surgeons to work with the general surgeons on these extensive injuries.

Civilian wounds, with any considerable loss of tissue, should be considered for immediate grafting, according to the advice of Stevenson and Reid.[20] Small superficial wounds can be closed painlessly, Gosis [21] reports, by laying strips of adhesive tape on prepared skin about ¼ inch (0.6 cm.) from the wound and parallel to it and placing sutures between the edges of the adhesive tape.

For cases in which tissue of any amount must be brought in by grafts or pedicle flaps, Gillies [22] discusses the advantages of tubed flaps over free grafts in certain instances. The common donor sites for tubed

17. Douglas, B.: Advances in the Treatment of Everyday Wounds, South. M. J. **32**:1171 1182 (Dec.) 1939.

18. Farmer, A. W.: Treatment of Avulsed Skin Flaps, Ann. Surg. **110**: 951-960 (Nov.) 1939.

19. Axhausen, G.: Die Behandlungsgrundsätze bei den Kriegs-Schussverletzungen der Kiefer und des Gesichtes, Ztschr. f. Stomatol. **37**:436-440 (April 28) 1939.

20. Stevenson, J., and Reid, M. R.: The Treatment of Traumatic Wounds, Am. J. Surg. **69**:442-450 (Dec.) 1939.

21. Gosis, M.: Painless Rendering Closure of Superficial Wounds, Am. J. Surg. **44**:400-403 (May) 1939.

22. Gillies, H.: Practical Uses of the Tubed Pedicle Flap, Am. J. Surg. **43**:201-215 (Feb.) 1939.

pedicle flaps are evaluated from the point of view of safety and special advantages. The general plan of outlining the reconstruction prior to operation is stressed. Specific examples with photographs of cases showing the use of the various pedicle flaps illustrate: restoration of half the face, including eyelid, nose and lips; replacement of the chin and lower half of the cheek; extensive losses of skin of the neck; defects of the axilla and upper part of the arm; massive avulsion of the scalp; reconstruction of the external ear; total rhinoplasty, and total reconstruction of the lower lip. The general operative technic of the two common tubed pedicle flaps (acromiopectoral and oblique abdominal) are given in precise detail. The sutures used and how the operation is performed are described and illustrated.

According to Maltz,[23] one disadvantage of the tubed pedicle flap is that when it is used for the face, it cannot be spread out smoothly and evenly, owing to arching which develops while it is in the tubed form. His technic turns the tube with the raw surface out, and the tube must therefore be protected with sterile petrolatum dressings while awaiting transfer.

The general treatment of burns, such as the prevention of shock and the combating of dehydration and acidosis, is well recognized and practiced. The local treatment of the burned areas, however, varies considerably. Cogswell and Shirley [24] report their experience with 2,000 cases of burns, stating that in their hands the "tubbing" method is superior to the various "tanning" methods.

Smith, Risk and Beck [25] carried on an experimental study with rats in regard to the rate of recovery in ordinary air at room temperature and in warm moist air and noted that the healing of burns was more rapid in the warm moist atmosphere.

Coughlin [26] recommends the "tanning" method and stresses the necessity of undertaking grafting and reconstructions as soon as possible to prevent scarring and contractures.

Padgett [27] has introduced a new term "calibrated grafts," indicating those cut by a precision skin grafting machine to cut grafts of known dimension. The results secured are superior to any previously obtained.

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23. Maltz, M.: New Method of Tube Pedicle Skin Grafting, Am. J. Surg. **43**:216-222 (Feb.) 1939.

24. Cogswell, H. D., and Shirley, C.: The Treatment of Burns, Am. J. Surg. **45**:539-545 (Sept.) 1939.

25. Smith, S.; Risk, R., and Beck, C.: Moist Air Therapy for Burns, Arch. Surg. **39**:686-689 (Nov.) 1939.

26. Coughlin, W. T.: Contractures Due to Burns, Surg., Gynec. & Obst. **68**:352-361 (Feb.) 1939.

27. Padgett, E. C.: Skin Grafting in Severe Burns, Am. J. Surg. **43**:626-636 (Feb.) 1939.

For the treatment of scars and contractures, Davis and Kitlowski [28] have used the "Z plastic" extensively. In the outlining of the "Z" the 60 degree angle is the one of choice, if possible. This procedure allows removal of the underlying scar and transposition of flaps of skin, which produce relaxation. Whatever pull there is, is now across the previous scar line. It is particularly valuable for such distortions as occur at the corners of the eyelids, mouth or webs of the fingers but lends itself equally well to repair of large contractures of the axilla or of the elbow.

For the closing of clean wounds, the choice of suturing material was studied by Guthrie, Brown and Woodhouse.[29] Reporting on 470 clean operations, the authors noted an incidence of infection of 2.9 per cent when catgut was used and of 1.27 per cent when silk was used. They feel that the silk offers definite advantages as a suture material.

PLASTIC OPERATIONS ON THE FACE

The treatment of pigmented nevi was formulated by Maliniac [30] as exclusively surgical removal. Radium and roentgen therapy are inferior to surgical procedures. The choice of simple excision, skin rotation or skin grafting depends on the nature and the extent of the growth.

Dermatologic conditions may require removal and coverage with new skin. Oliver [31] describes such chronic destructive lesions as carcinoma, lupus, syphilis, blastomycosis and actinomycosis. Barsky [32] has outlined his management of such dermatologic conditions as hairy mole, paraffinoma and angioma.

For infections and cellulitis of the face, Scarpellino and Stookey [33] report definite value in the intramuscular use of 10,000 units of staphylococcus antitoxin. For the treatment of deeper infections of the face involving the muscular fascial spaces, Dingman [34] has reviewed the incisions most likely to drain the various areas successfully.

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28. Davis, J. S., and Kitlowski, E. A.: The Theory and Practical Use of the Z Incision for the Relief of Scar Contractures, Ann. Surg. **109**:1001-1005 (June) 1939.

29. Guthrie, D.; Brown, M. J., and Woodhouse, K. W.: Advantages of Silk in General Surgery, New York State J. Med. **39**:2011-2018 (Nov. 1) 1939.

30. Maliniac, J. W.: Pigmented Nevi, with Special Reference to Their Surgical Treatment, Am. J. Surg. **45**:507-510 (Sept.) 1939.

31. Oliver, E. A.: The Diagnosis and Treatment of Chronic Destructive Lesions of the Face and Neck, M. Clin. North America **23**:245-259 (Jan.) 1939.

32. Barsky, A. J.: The Surgical Repair of Unusual Dermatological Conditions, S. Clin. North America **19**:459-466 (April) 1939.

33. Scarpellino, L., and Stookey, P. F.: Staphylococcus Cellulitis of the Face: Prophylactic Treatment with Report of Cases, J. Missouri M. A. **36**:239-243 (June) 1939.

34. Dingman, R. O.: Acute Infections of the Face, Pennsylvania M. J. **42**: 499-505 (Feb.) 1939.

The great increase in the number of automobiles and in speed has taken an increasing toll of lives. The injured are often severely disfigured. For examining the face and underlying bony parts, Bellinger [35] suggests following a systematized plan so that the frontal sinus, nasal bones, nasal septum, orbital rim, antral walls, malar and zygomatic bones, maxilla, mandible and alveolar bones are noted. For depressed fractures of the malar bone, the intra-antral method gives uniformly good results. Depressed zygomatic bones can be elevated by the Gillies method of external operation from above the hair line. The management of fractures of the bones of the face is discussed also by Smith [36] and by Whitham.[37] Brown [38] presents histories of cases of severe complicated facial injuries and his method of handling them.

The soft tissues, according to von Wedel,[39] should be treated by copious lavage and conservative débridement and should be sutured as soon as possible. The fractures, however, may be reduced up to seven to ten days later if desirable.

Traumatic injuries to the eye and adnexa are often poorly repaired owing to the minuteness of the anatomic structures and a lack of appreciation of the functions of these parts. Whitney [40] states that the lids may be torn from either the outer or the inner canthus and left hanging at one extremity or the other. A line of tear first vertical will often follow the retrotarsal fold across the eye. This indicates that the levator muscle has been disrupted and must first be sewed back to the posterior border before the orbicularis muscle and cutaneous structures are considered. Adherence to this procedure will often prevent a permanent ptosis.

Vertical lacerations must be closed by the "halving method." The tarsal plate is first sutured accurately. The orbicularis fibers are then lapped over the tarsal closure and reenforced by mattress sutures through all the structures. This will prevent unsightly notches.

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35. Bellinger, D. H.: Fractures and Dislocations of the Jaws and Wounds of the Face, Am. J. Surg. **46**:535-541 (Dec.) 1939.

36. Smith, G. W.: Fractures of the Facial Bones, Rocky Mountain M. J. **36**:238-241 (April) 1939.

37. Whitham, J. D.: The Treatment of Fractures of the Face and Nose, in Symposium on Head Trauma: Diagnosis and Treatment, Laryngoscope **49**: 394-401 (May) 1939.

38. Brown, J. B.: Fractures of the Bones of the Face, Surg., Gynec. & Obst. **68**:564-572 (Feb.) 1939; The Management of Compound Injuries of the Face and Jaws, South. M. J. **32**:136-144 (Feb.) 1939; Fractures of the Bones of the Face, Am. J. Orthodontics **25**:432-446 (May) 1939.

39. von Wedel, K.: Role of Plastic Surgery in Injuries of the Face, South. M. J. **32**:1119-1121 (Nov.) 1939.

40. Whitney, E. L.: Traumatic Injuries to the Eye and Its Adnexa, Am. J. Surg. **69**:486-495 (Dec.) 1939.

Surgery offers complete success in premalignant conditions, is often life saving during the course of such diseases and is of great aid in restoring appearance and function when the disease has been eradicated. Burton [41] evaluates the contributions which surgery can make in the management of malignant conditions about the face, while New and Erich [42] attack the specific problem of the repair of postoperative defects of the lips following the treatment of malignant disease.

Defects of the upper lip are relatively uncommon as compared with those of the lower lip. Small defects can be closed by using an inverted V-shaped wound, with closure in layers. Larger defects are closed by the use of lateral cheek incisions, to allow tissue to be brought in from the sides, or by the Estlander operation, which consists of transferring a wedge of tissue from the normal lip to the opposite lip. More extensive defects are closed by the use of skin-lined pedicle flaps. Small defects of the lower lips are closed by the use of a wedge-shaped wound and simple closure. The large defects require a pedicle flap, which is conveniently raised from the cervical or clavicular areas.

Daland [43] points out that the problem in reconstructing a lip where one half to two thirds has been removed is the restoration of the orbicularis oris muscle. Daland's operation consists of (*a*) rectangular excision of the growth, (*b*) lateral incisions extending from the lower border of the defect, (*c*) separation of the mucous membrane from the skin and muscle for midline approximation, (*d*) division of the digitations of the peripheral muscles to the orbicularis oris up to ½ inch (1.3 cm.) above the level of the commissure and (*e*) closure of the muscle and skin in layers to produce rotation of the commissures and to restore the continuity of the orbicularis muscle. The resulting mouth is somewhat smaller, but satisfactory from a therapeutic, functional and cosmetic point of view.

The correction of facial paralysis has been developed in several directions. Tickle's [44] observations on over 200 cases reveal that the preliminary operation of cutting the selected nerve graft and allowing wallerian degeneration two to three weeks before grafting is unnecessary.

For postoperative paralysis of the seventh nerve which is present immediately after the operation, reoperation and suture of the cut ends

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41. Burton, J. F.: The Role of Plastic Surgery in the Treatment of Malignancies About the Face, South. M. J. **32**:67-68 (Jan.) 1939.

42. New, G. B., and Erich, J. B.: Repair of Postoperative Defects of the Lips, Am. J. Surg. **43**:237-248 (Feb.) 1939.

43. Daland, E. M.: Repair of Large Defects After Removal of Cancer of the Lips, Surg., Gynec. & Obst. **69**:347-357 (Sept.) 1939.

44. Tickle, T. G.: Nerve Graft Operation for Facial Paralysis, Laryngoscope **69**:475-481 (June) 1939.

are indicated at once, since for forty-eight to seventy-two hours one has the advantage of picking up the distal segment of the injured nerve by means of faradic stimulation.

About 15 per cent of patient's with Bell's palsy lose their faradic response. Tickle feels that this finding is an indication for decompression of the nerve.

For grafting, the anterior femoral nerve is selected. The graft is laid in without sutures between the cut ends and is carefully protected with gold leaf foil over it.

Bunnell and Boyes [45] report 32 various nerve grafts treated by perineural suturing with the finest silk and without the use of free fat, membrane or any foreign body around the junctions and feel that their results indicate this method to be superior to any other.

For cases in which nerve grafting is not feasible, Brown [46] uses fascia slips threaded down subcutaneously from the temporal area to the upper lip and angle of the mouth and threaded back again, to be hooked around portions of the temporal muscle as a sling. This will restore the symmetry of the face and afford some motion.

Brunner's [47] technic is to expose the anterior border of the masseter muscle intraorally and to raise a muscle flap which is threaded anteriorly to the commissure of the mouth and fixed there by suture. External counter drainage is instituted at the angle of the jaw.

Facial models are valuable for records, for teaching purposes and as aids in outlining various operations or restorations. West [48] has described the technic of taking an impression with one of the hydrocolloidal compounds, the pouring of a sterilizable cast in plaster and contouring the cast with dental wax to approximate what the restoration shall be like when completed.

Bulbulian [49] uses plaster for the impression and favors making the cast in a wax which permits easy workability, is lifelike and can be painted. Full technical details and the formula for the wax are given in the article.

The making of prosthetic latex restorations of facial defects for temporary, interval or permanent use has been greatly simplified and

45. Bunnell, S., and Boyes, J. H.: Nerve Grafts, Am. J. Surg. **44**:64-75 (April) 1939.

46. Brown, J. B.: The Utilization of the Temporal Muscle and Fascia in Facial Paralysis, Ann. Surg. **109**:1016-1023 (June) 1939.

47. Brunner, H.: The Clinical Significance and the Treatment of Otogenous Facial Paralysis, Laryngoscope **49**:276-291 (April) 1939.

48. West, B. S.: A Technic for Producing Facial Masks and Models, Ann. Surg. **109**:474-478 (March) 1939.

49. Bulbulian, A. H.: A Simple and Practical Technic for Making Facial Casts, J. Am. Dent. A. **26**:347-354 (March) 1939.

standardized by Bulbulian.[50] The impression is made in "soluble" plaster and the cast made in casting plaster. The pattern of the defect is built up in dental wax and a mold made by completing the plaster cast and eliminating the wax by low heat. The mold is channelized and then cast by using the following solutions and heating them at 70 C. for twenty-four to forty-eight hours. Solution A contains 3 Gm. of zinc oxide mixed with 5 cc. of distilled water and 200 cc. of vultex (a prevulcanized liquid latex, made by the Vultex Company, Cambridge, Mass.). Solution B contains 1 Gm. of Biebrich scarlet (scarlet red) dissolved in 120 cc. of distilled water. To 50 cc. of solution A add 2 drops of solution B.

PLASTIC OPERATIONS ON THE NOSE

Examples of the effectiveness of plastic operations to correct many types of nasal deformities were published by Cox,[51] Castellano and Giganti,[52] and Malbec.[53]

The relation of the bridge of the nose to the face at various age levels was studied by Goldstein [54] in 500 males between 3 and 21 years of age. The phylogenetic explanation for the elevation of the nose seems to be primarily the reduction or regression of the dental arch, with an increase in the volume of the brain and an increase in the size of the ascending process of the maxillary bone contributing to the trend. Periods of special activity in development of the nasal bridge are between the ages of 3 and 5 years and 11 and 13 years. Indirect evidence suggests that forward growth appears to cease around the age of 17.

Berson [55] discusses the relation between component parts of the nose and the face in an attempt to secure a general ideal value for the best esthetic results. For such measurements he uses the profilometer and tilometer.

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50. Bulbulian, A. H.: An Improved Technic for Prosthetic Restoration of Facial Defects by Use of a Latex Compound, Proc. Staff Meet., Mayo Clin. **14**:433-439 (July 12) 1939; Prosthetic Restoration of Facial Defects by Use of Latex Compound: A Further Detailed Description of the Technic Used, ibid. **14**:721-728 (Nov. 15) 1939.

51. Cox, G. H.: Deformities of the Ear and Nose Treated by Plastic Surgery, New York State J. Med. **39**:1956-1961 (Oct. 15) 1939.

52. Castellano, J. L., and Giganti, M.: Cirugía plastica y estética, Semana méd. **1**:1337-1343 (June 8) 1939.

53. Malbec, E. F.: Cirugía correctora nasal, Semana méd. **1**:365-375 (Feb. 16) 1939.

54. Goldstein, M. S.: Development of the Bridge of the Nose, Am. J. Phys. Anthropol. **25**:101-117 (April) 1939.

55. Berson, M. I.: Construction of the Ideal Nose with the Aid of Masks and Measurements, M. Rec. **149**:80-82 (Feb. 1) 1939.

The foundation of the nasal pyramid is the nasal septum. Cohen [56] stresses the need of preserving it as far as possible in plastic and submucous operations so that it can continue to serve its function of chief support of the nose. Distortion of the septum is usually accompanied by distortion of the lateral cartilages as well. The operation, according to Cohen, and also as stressed by Metz,[57] attains its objective when the lateral cartilages are adjusted to the septum which has been replaced in the midline.

If the traumatized nose is associated with bony displacement, immediate reposition if possible is indicated. In regard to associated lacerations, Renie [58] prefers to defer the suturing until the subsidence of edema.

Straith [59] recommends the subcuticular method of suturing. Any loss of superficial skin should be replaced with a graft immediately if feasible.

The twisted nose must have detailed analysis of the parts involved before one undertakes correction. Metz [57] recommends that if bony displacement is present intranasal removal of a small wedge of the hypertrophied side be carried out to allow room for replacement of the nasal bones in the midline position. Usually there is a tendency for recurrence of the deformity while the healing period is going on, so that Metz produces an overcorrection and keeps the nose in that position by a modeling compound splint which extends down by an arm of a plaster head cap. The cartilaginous readjustments may be performed at the same time or in a subsequent operation.

Lillie and Simonton [60] have found that nasal obstruction to breathing may in some cases be due to alar collapse. An intranasal splint is helpful, while stiffening and eversion of the ala surgically will produce complete alleviation of the symptoms.

Nasal obstruction may also be due to such causes as occlusion of the choanae. This is usually of congenital origin, although the acquired type has occurred following surgical treatment of the adenoidal area in patients who may be prone to excessive scar formation following any

56. Cohen, S.: Role of the Septum in Surgery of the Nasal Contour, Arch. Otolaryng. **30**:12-21 (July) 1939.

57. Metz, W. R.: The Twisted Nose, New Orleans M. & S. J. **92**:180-185 (Oct.) 1939.

58. Renie, R. O.: Management of the Traumatized Nose, S. Clin. North America **19**:467-473 (April) 1939.

59. Straith, C. L.: Reconstructions About the Nasal Tip, Am. J. Surg. **43**: 223-236 (Feb.) 1939.

60. Lillie, H. I., and Simonton, K. M.: Nasal Obstruction Caused by Collapse of the Nasal Alae, Ann. Otol., Rhin. & Laryng. **48**:600-608 (Sept.) 1939.

type of trauma. In summarizing 12 cases of congenital involvement, Pastore and Williams [61] reported that the occlusion was completely bony in 8, partially bony in 1, membranous and bony in 1 and membranous in 2 cases. In a detailed case report a bilateral occlusion in a newborn baby is described. It was corrected at the age of 9 days by making an opening surgically and maintaining the patency with rubber tubing until epithelization took place. The second case was that of a 14 year old boy with a unilateral congenital occlusion, which was corrected by a submucous septal resection plus removal of the posterior obstruction down to the level of the surrounding structures. Kelly's [62] patient was similarly treated, and on follow-up examination three years later the result was satisfactory.

Two rather rare congenital nasal deformities were discussed by Kopp.[63] A bifid nose has as its distinguishing feature a separation of the nose by a furrow. The operative correction consisted of a submucous resection followed by a narrowing of the upper part of the nose by the usual Joseph technic. Then the lower lateral cartilages were freed, the intervening soft tissues removed and the cartilages brought together by suture.

Analysis of the bulldog deformity revealed that the nasal bones and the frontal processes of the maxilla were rudimentary while the lateral cartilages were absent. The columella was short. There was atresia of the right nasal chamber. The rhinoplastic correction consisted of making the nares patent, lengthening the columella at the expense of the upper part of the upper lip and building up the nasal dorsum with a cartilage graft.

Laff [64] has called attention to the enormous distention and disfigurement of the nose which may occur in young people as a result of persistently recurring polyps.

For prosthetic restoration of a nose removed because of a malignant lesion, Claflin [65] constructed a nose of thin vitallium and soldered it to a spectacle frame. The result was most satisfactory.

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61. Pastore, P. N., and Williams, H. L.: Congenital Occlusion of the Nasal Choanae: Brief Review of Twelve Cases, Proc. Staff Meet., Mayo Clin. **14:** 625-627 (Oct. 4) 1939.

62. Kelly, D. B.: Congenital Occlusion of Posterior Nasal Choanae, Brit. M. J. **1:**157-158 (Jan. 28) 1939.

63. Kopp, M.: Two Congenital Nasal Deformities: Bifid Nose and Bulldog Nose, Laryngoscope **69:**1128-1133 (Nov.) 1939.

64. Laff, H. I.: Deforming and Recurring Polyps of Youth, Arch. Otolaryng. **30:**795-799 (Nov.) 1939.

65. Claflin, R. S.: Construction of a Nose by Prosthesis, Am. J. Orthodontics **25:**92-93 (Jan.) 1939.

PLASTIC OPERATIONS ON THE EARS

Congenital deformities of the ear were classified by Coe [66] as abnormalities in size and/or shape, defective or absent portions, accessory auricles and faulty development of the external auditory canal. There appears to be a constant relation between defects of the external ear and of the internal ear, and hearing in the presence of the more marked defects is by bone conduction.

Klicpera [67] differentiates the cause of protruding ears as (*a*) lack of development of the anthelix, (*b*) abnormal angle at which the concha is attached to the external auditory canal and (*c*) mixed causes. In undertaking the surgical correction, the elliptic excision is chiefly confined to the pinna as an aid in reconstructing the anthelix in the first group, while the postauricular mastoid crevice is the point of approach in the second group.

So-called "dog" or drooping ear has little if any anthelix formation, and, in addition, the ear sags below the level of the opposite or normal ear. Rigg and Waldapfel [68] correct this deformity by first removing an ellipse of skin from the auricular mastoid fold. A bridge of cartilage is then turned up from the auricle, tucked under the temporal periosteum and sutured there to maintain the ear in the correct position.

For a congenital atresia of the external auditory canal Novick [69] used electrosurgical excision, with marked success. Macomber [70] presents a case report of a young man with a traumatic loss of the lower half of the left ear, the outer half of the auditory meatus, part of the parotid gland and considerable overlying skin. Correction was carried out, the seventh nerve being sutured and the lost skin restored by a Thiersch graft. The stenosed external auditory canal was enlarged, and skin was grafted to maintain the patency. The missing lobe was restored by a tube graft into which cartilage had been inserted for firmness.

PLASTIC OPERATIONS ON THE JAWS AND PALATE

The removal of teeth the roots of which project up into the floor of the maxillary sinus may occasionally be complicated by the formation

66. Coe, H. E.: Congenital Deformities of the External Ear, Northwest Med. **38**:135-136 (April) 1939.

67. Klicpera, L.: Zur Korrektur der abstehenden Ohren, Wien. klin. Wchnschr. **52**:536-538 (June 2) 1939.

68. Rigg, J. P., and Waldapfel, R.: Plastic Repair with Cartilagoperiosteal Bridge in Drooping (or Dog) Ear, J. A. M. A. **113**:125-126 (July 8) 1939.

69. Novick, J. N.: Atresia of the External Auditory Meatus, Arch. Otolaryng. **30**:744-748 (Nov.) 1939.

70. Macomber, D.: Reconstruction of the External Ear, Rocky Mountain M. J. **36**:37-40 (Jan.) 1939.

of an antroalveolar fistula. Ashley [71] outlines an operation to close such a fistula by first curetting the lining from the fistula. A flap about one third larger than necessary is raised from the palate and rotated into the defect. Its distal edge is freshened and wedged into place, and the edges of the mucous membrane are sutured with silk.

Severe trauma to the upper jaw may be associated with orbital, antral, nasal and malar fractures. The displacement of the maxilla, which is usully down and back, will cause malocclusion of the teeth.

The orbital disorganization may cause a lowering of the eye and muscular imbalance so that severe diplopia is present, as in the case described by Paoli.[72] If the eye cannot be restored to a satisfactory level by repositioning of the orbital floor, it may be necessary later to insert a piece of cartilage to fill out the depression beneath the eye and also to act as a support for the orbital contents. Usually the fractures of the maxilla require external traction to hold them in position, and this is accomplished, as described by Paoli,[72] Bellinger,[35] Brown [38] and Whitham,[37] by the use of arms extending down from a plaster head cap.

The lower jaw is much more frequently fractured than the upper jaw. Asbell [73] analyzed 115 fractures of the jaw and noted that the mandible was involved in 90 per cent. The majority of the fractures occurred in the age group from 20 to 30, and over 30 per cent were due to automobile accidents. About 75 per cent were single fractures, 19 per cent double fractures and 5 per cent multiple. The most common sites are the molar region, the mental region and near the angle of the mandible.

The usual mandibular fracture is easily diagnosed because of pain and disability. Examination reveals an abnormality in the relation between the upper and the lower teeth, and often the mouth cannot be closed very far. The average mandibular fracture is easily reduced and maintained in good occlusal position by the use of intermaxillary wiring. Bellinger [35] and Dingman [74] feel that some motion should be allowed and advocate the use of rubber bands as intermaxillary links.

The temporomandibular joint is subject to subluxation and dislocation. It may also be invaded by bacteria from either neighboring or distant infectious foci, and fibrosis and even bony ankylosis may result.

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71. Ashley, R. E.: A Method of Closing Antro-Alveolar Fistulae, Ann. Otol., Rhin. & Laryng. **48**:632-641 (Sept.) 1939.

72. Paoli, M.: Fractures des os maxillaires supérieurs et inférieurs; fracture des os malaires, diplopie, Rev. de stomatol. **41**:548-552 (July) 1939.

73. Asbell, M. B.: Analysis of One Hundred and Fifteen Cases of Fractures of the Jaws, Am. J. Orthodontics **25**:282-289 (March) 1939.

74. Dingman, R. O.: The Use of Rubber Bands in the Treatment of Fracture of the Bones of the Face and Jaws, J. Am. Dent. A. **26**:173-183 (Feb.) 1939.

The recognition and treatment of the disturbances of the temporomandibular joint have been reviewed by Wakeley,[75] Buchman [76] and Ginestet, Roy and Houpert.[77]

The body of the mandible may be deformed with or without involvement of the joint. It rarely may be entirely absent, as reported by Kazanjian,[78] who presents a report on the reconstruction of a unilateral jaw from a tibial bone graft. The chief deformities of the mandible are classified by Kazanjian [79] as (*a*) bone losses of the mandible, (*b*) maldevelopment and retrusions and (*c*) overdevelopment. His article covers the surgical treatment of these various deformities. The general subject of bone and cartilage grafting for functional defects and tissue losses of the mandible was summarized by Weisengreen.[80]

The jaws are often deformed by intrinsic growths which are predominantly benign but may be malignant. The benign growths have been reviewed by Havens,[81] while the difficulty of diagnosing and treating malignant lesions of these regions was illustrated by a case of adamantinoma of the superior maxilla with intracranial extension reported by Androp [82] and a case of medullary osteosarcoma described by Pack and Boyko.[83]

The surgical approach to the maxillary sinus for extensive removal or treatment of malignant disease may produce an objectionable communication with the oral cavity. Pietrantoni [84] has devised an external operation, using an incision along the dorsum of the nose and turning the soft tissue inward to form a floor for the maxillary sinus to prevent

75. Wakeley, C. P. G.: The Surgery of the Temporo-Mandibular Joint, Surgery **5**:697-706 (May) 1939.

76. Buchman, J.: Lesions of the Temporo-Mandibular Joint, Am. J. Orthodontics **25**:355-377 (April) 1939.

77. Ginestet, G.; Roy, M., and Houpert, M.: Chirurgie orthopédique de l'articulation tempéro-maxillaire, Rev. de stomatol. **41**:520-532 (July) 1939.

78. Kazanjian, V. H.: Congenital Absence of the Ramus of the Mandible, J. Bone & Joint Surg. **21**:761-777 (July) 1939.

79. Kazanjian, V. H.: Jaw Reconstruction, Am. J. Surg. **43**:249-268 (Feb.) 1939.

80. Weisengreen, H. H.: Bone Ligation and Suture in Relation to Functional Defects and Tissue Losses in the Mandible, Internat. Abstr. Surg. **68**:450-460, 1939; in Surg., Gynec. & Obst., May 1939.

81. Havens, F. Z.: Benign Cysts and Adamantinomas of the Jaws, Arch. Otolaryng. **30**:762-774 (Nov.) 1939.

82. Androp, S.: Adamantinoma of the Superior Maxilla with Intracranial Extension, Laryngoscope **69**:118-122 (Feb.) 1939.

83. Pack, G. T., and Boyko, G. V.: Resection of the Mandible for Medullary Osteosarcoma, Am. J. Surg. **43**:754-757 (March) 1939.

84. Pietrantoni, L.: Di un metodo personale di plastica del palato Dopo asportazione di voluminosi osteomi del mascellare superiore, Valsalva **15**:205-212 (May) 1939.

such a communication. Walker [85] solved the problem by closing the palatal defect by an obturator and filling in the facial defect and supporting the eye in its normal position by a prosthetic appliance attached to the lower rim of a spectacle frame.

Congenital defects of the lips usually manifest themselves as clefts. Baxter [86] has recently reviewed the rather rare congenital pits and fissures one finds in the lower lip. The embryologic basis for cleft lip and palate was studied by Jorge and Piazza de Rosenfeld.[87]

Distribution of defects of the lip and palate in 80 cases was reported by Guilleminet and Guillet,[88] who grouped them according to the extent of the involvement, with the following result:

Unilateral partial cleft lip	11 cases
Bilateral partial cleft lip	3 cases
Unilateral complete cleft lip	23 cases
Bilateral complete cleft lip	10 cases
Cleft palate	33 cases

The objectives of an operation to correct a cleft palate, according to Smith and Johnson,[89] should be:

1. The ends of the orbicularis oris muscle must be approximated.
2. The corresponding nostril must be restored to its normal contour.
3. The edges of the vermilion border must be accurately placed in alinement.
4. The scar line of the cleft must be reduced to a minimum.

In closure of a cleft lip, the width and position of the alveolar cleft are disregarded; its approximation is dependent on the molding effect of the repaired lip. According to Blair,[90] it is necessary to recognize and plan for the correction of incidental displacements as well as to close the cleft. The position and shape of the two nares rarely coincide, so that there must be a reestablishment of the relations of the divided alveolar process, the lips, the alae and the columella to a normal position if the closure is to be successful.

Most operators close the lip in children from 1 to 6 months of age and usually defer the closure of the palatal defect until they are

85. Walker, D. G.: An Aid to Prosthetic Restorations of the Maxilla After Excision, Lancet **1**:1209-1210 (May 27) 1939.

86. Baxter, H.: Congenital Fistulas of the Lower Lip, Am. J. Orthodontics **25**:1002-1007 (Oct.) 1939.

87. Jorge, J. M., and Piazza de Rosenfeld, A.: Malformaciones y deformaciones de maxilares, Semana méd. **1**:1221-1242 (June 1) 1939

88. Guilleminet and Guillet: Chirurgie du bec-de-lièvre, Lyon chir. **36**:197-201 (March-April) 1939.

89. Smith, A. E., and Johnson, J. B.: Surgery of the Cleft Palate, Am. J. Surg. **45**:93-103 (July) 1939.

90. Blair, V. P.: Distortions Accompanying Congenital Single Lip Cleft, Nebraska M. J. **24**:41-43 (Feb.) 1939.

3 years old. Schultz [91] closes narrow palatal clefts in children 3 to 4 months of age. If the cleft is too wide, he resorts to molding of the osseous tissues to narrow the cleft and then a few weeks later completes the closure.

The final criterion of the success of an operation to correct a cleft palate is the quality of the speaking voice obtained. In 1925 Davis,[92] who had been using both the mucoperiosteal sliding flap and the osteoplastic method, studied his results and concluded that the best functional results were found in those cases in which the palate had been successfully closed by the osteoplastic operation. He has been using the osteoplastic flap operation exclusively since 1925. The operation is in two stages, preferably done between the ninth and the twenty-second month. In the first stage the osteoperiosteal flaps are mobilized by a meticulous technic which is described in detail and illustrated in the article; and seven to twelve days later the flaps are stabilized by wire sutures, and the cleft in the soft tissue is closed with silk. Davis feels that this method offers the minimum raw area on the nasal side of the palate and consequently less scar tissue contraction and secures the greatest possible length to the palate, the least interference with muscle action and the best quality speaking voice.

The Axhausen operation for closure of the palate is also aimed at eliminating the raw area on the nasal side of the palate. In order to secure this result, the nasal mucosa is carefully dissected off from the palatal bones and closed as a lining before the muscle sutures and oral sutures are placed. While this method is feasible in cases of complete cleft, in cases of partial unilateral cleft it is difficult to obtain nasal mucosa as lining on the unaffected side, owing to the position of the vomer. Wassmund [93] removed a triangle from the lower edge of the vomer so as to expose the nasal mucosa on that side. Then the two flaps can be brought together in the midline and closed easily.

For effective speech, the palatal length must be sufficient to allow closure at the posterior portion of the pharynx, at Passavant's cushion. To achieve this end, Hagentorn [94] has devised an operation which raises the palatal flaps as though they were the side incisions of a "Z" plastic, with the cleft being the connecting arm. By the usual transposition of

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91. Schultz, L. W.: Cleft Palate Surgery, Illinois M. J. **75**:127-131 (Feb.) 1939.

92. Davis, W. B.: The Value of Osteoplastic Flaps in Cleft Palate Repair, Pennsylvania M. J. **43**:153-159 (Nov.) 1939.

93. Wassmund, M.: Zur Operation der einseitigen Gaumenspalte, Zentralbl. f. Chir. **66**:994-999 (April 29) 1939.

94. Hagentorn, A.: Ueber Gesichtsplastiken, Arch. f. klin. Chir. **195**:455-488, 1939.

the flaps, it is possible to close over the cleft and secure lengthening of the palate. The bare areas at the sides are allowed to granulate in.

In addition to a good operative result, it is highly important, say Froment and Feyeux,[95] that the patient with cleft palate receive speech training postoperatively, as a period of reeducation is absolutely necessary.

Secondary deformities in patients with cleft palates were classified by Kazanjian [96] as being due to preventable factors, such as surgical technic and infections, or to nonpreventable factors, such as maxillary underdevelopment, retrusion and malocclusion.

The secondary deformities of the nose are difficult to classify but may be grouped under the following types:

1. There may be distortion and flatness of the nostril on the side of the original defect.

2. The entire nose may be bent to one side.

3. The lip may be broad and flat, especially in cases in which the condition is bilateral.

With Kazanjian's technic to correct the distorted nostril a curved incision in the skin is used, freeing the nostril from the base of the nose. A vestibular incision is made bilaterally along the anterior border of the lower lateral cartilages and extends down through the lower border of the septum. The skin over the tip and lateral cartilages is freed. The distorted lateral cartilage is at a lower level at its septal attachment than the other side. This is made even. If the tip is to be raised and narrowed, the alar cartilages are incised and sewed back to back. In order to bring the wing of the nostril to its assigned position it is necessary to excise a triangular piece of skin from the upper part of the nasolabial line and suture the borders in a horizontal line. The upper margin of the nose is raised by excision of a semilunar piece of skin about 3 mm. above the margin.

Correction of a flat lip requires elongation of the columella and bringing in tissue to the lip to reduce shortening and tension. Contouring of the upper lip is often greatly aided by a suitable dental appliance.

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95. Froment and Feyeux, A.: La rééducation phonétique après intervention pour division vélo-palatine et les conditions sine qua non d'une amélioration du langage, Lyon chir. **36**:201-207 (March-April) 1939.

96. Kazanjian, V. H.: Secondary Deformities in Cleft Palate Patients, Ann. Surg. **109**:442-467 (March) 1939.

Abstracts from Current Literature

Ear

CARE OF MASTOID WOUNDS FOLLOWING THE COMPLETE MASTOID OPERATION, SINUS THROMBOSIS AND OPERATION ON THE PETROUS PYRAMID. MARVIN F. JONES, Ann. Otol., Rhin. & Laryng. **48**:579 (Sept.) 1939.

The aims are painless dressings, a good cosmetic result, the restoration of function and a short period of disability. After the operation the author closes the wound with two or three Michel clamps and places in it the largest Sirus drain, with one end in the antral area and the other coming out of the lower end of the wound. A plain drain moistened with alcohol and boric acid, equal parts, is placed in the external canal. The outer dressings and the drain in the external canal are changed daily. On the fourth or fifth day the clamps are removed and the Sirus drain changed for a smaller. The number of days between dressing depends on the discharge; an interval of one to three days is preferable. The time of healing is one to four weeks when complications are not present.

Sometimes a wound must be left open. Secondary closure is done some days later, and the care after this is the same as that described. If there is a persistent sinus the author opens the mastoid cavity, elevates the periosteum some distance posterior to the wound, removes nonviable epithelium and makes a second incision parallel to the first but 1 to 2 inches (2.5 to 5 cm.) posterior. The first incision is closed with clamps; the posterior wound may be closed seven to ten days later but often heals spontaneously.

When the lateral sinus and the jugular vein have been operated on he dresses each wound with a fresh sterile setup. An oil silk apron is fastened to the neck between the two wounds to prevent contamination of the lower with drainage from the upper. For children or nervous patients the first dressing is done with anesthesia. In dressing the spinal wound the author removes the lower plug first, as there is less likely to be bleeding with the jugular vein ligated. Then the upper plug is removed. If bleeding does occur the plug is left in place and removal tried daily until there is no bleeding. After the plugs have been removed a secondary closure is done.

Petrositis.—The wound is left open and packed with gauze; a small rubber tube or wick of rubber tissue is placed near the discharging sinus; the gauze is packed loosely about the drainage material but tightly elsewhere. Granulations rapidly form and must be removed by a curet in order to keep up the drainage. A small suction tube is helpful. After all symptoms and drainage have disappeared, secondary closure is done.

If petrositis is attacked directly through the gasserian ganglion, then drainage may be made through this incision, rubber tissue or oiled silk being used as wicks. Drainage wicks should always be fixed to the skin so that they do not slip and are not pulled out with the dressings. If there has been a previous "searching operation" before the direct approach is made, the latter may be closed and drainage done through the first incision.

The author advocates as little manipulation of the wound as possible and uses physiologic solution of sodium chloride as a cleansing agent after flushing the wound with alcohol; he feels that too much wiping disturbs granulations and new epithelium. As stimulants in sluggish wounds he uses peruvian balsam. Excessive granulations he discourages with scissors and silver nitrate.

M. V. MILLER, Philadelphia.

CARE OF MASTOID WOUNDS FOLLOWING THE RADICAL AND MODIFIED RADICAL MASTOID OPERATIONS. J. MORRISSET SMITH, Ann. Otol., Rhin. & Laryng. **48**:585 (Sept.) 1939.

The author believes that much postoperative difficulty is due to faults of technic at operation. The chief fault is failure to lower the facial ridge properly. This should be taken down from the horizontal canal to a line parallel with the floor of the middle ear. All diseased bone should be removed to the dural plate in the middle and posterior fossae. The annulus is completely removed together with granulations in the middle ear and the eustachian tube; then the cells in the tubal area and the hypotympanic space are removed. He emphasizes the importance of the flap and outlines his method of making it. The wound is cleansed of all clotted blood and debris and then dried. It is lined with strips of rubber tissue and then packed with iodoform gauze. If the dura or the sinus is exposed a bit of iodoform gauze is placed in that area and the rest lined with rubber tissue. The periosteum and the temporal fascia are sewed back in their original positions with interrupted sutures.

The packing and tissue are removed the second day, and if bleeding is controlled the wound is not repacked. If bleeding persists the area is touched with a 10 per cent solution of cocaine and plain gauze is moistened with 95 per cent alcohol and inserted for twenty-four hours. All blood is carefully removed at each dressing. When the wound is dry, the bandage is removed and aeration of the cavity allowed, the wound being covered with gauze. Irrigations are not used in the cavity unless there is secondary purulent infection, in which event it is flushed with boric acid followed by 10 drops of 95 per cent alcohol. If alcohol is too painful a few drops of cocaine is used previous to the dressing. Excessive manipulation of the wound is discouraged. Silver nitrate may be used on the superficial infected layers of granulations but never on the bone. Excessive granulations are removed with a curet, after which a temporary alcohol gauze pack may be used. Some wounds may fill with healthy granulation in spite of careful treatment. If much hearing remains after the operation, this is of little moment, but, if hearing is to be preserved, skin grafts are valuable in keeping the inner wall of the middle ear free of granulations.

Daily dressing, with careful inspection of the wound by the operator, is essential for best results. The routine is modified as is indicated in the case. A slight mucoid discharge without odor is usually from the eustachian tube and does not require operation. A foul-smelling discharge persisting after a long period usually means necrosis and requires a secondary operation.

The same care is needed after the modified radical operation. Packing is placed in the posterior part of the wound but should not press on the remnants of the drum and ossicles. Plain gauze packing is used and effort made to keep granulations away from the antrum. If secondary infection occurs gentle irrigation is used to avoid disturbing the malleus and the incus.

M. V. MILLER, Philadelphia.

RECURRENCE OF OTITIC INFECTIONS DUE TO THE BETA-HEMOLYTIC STREPTOCOCCUS FOLLOWING INADEQUATE SULFANILAMIDE THERAPY. JOHN M. CONVERSE, J. A. M. A. **113**:1383 (Oct. 7) 1939.

The author presents a series of cases which were studied bacteriologically, preoperatively and postoperatively, and several in which the patient was admitted more than once into the hospital. The study deals with the question of the premature cessation of sulfanilamide treatment followed by the recurrence and extension of the original aural infection. Many details are discussed, and he is impressed by the observation that the institution of sulfanilamide therapy creates an obligation to continue it until there is bacteriologic as well as clinical evidence of complete subsidence of infection. He feels that premature cessation of the

administration of the drug on clinical evidence alone may permit an exacerbation of the infection in patients whose defensive mechanisms are not prepared to deal with residual living streptococci.

He comments that the absence of streptococci and pus cells in smears from the site of infection means bacteriologic sterility, that absence of streptococci in cultures made by planting swabs in 10 cc. of broth (it is necessary to dilute the exudate in broth to overcome the bacteriostatic effect of the drug) also indicates sterility, that cultures should be repeated from three to five days after the discontinuance of sulfanilamide therapy and prior to the discharge of the patient, that patients should be hospitalized for effective sulfanilamide therapy and that this therapy should be reserved for the treatment of life-endangering streptococcic infections.

GORDON, Philadelphia.

FORMS OF SUBACUTE OTITIS. A. D. ROSSI, Arch. ital. di otol. **51**:480 (Sept.) 1929.

Rossi describes 3 cases of subacute otitis, involving predominantly the epitympanum and the temporozygomatic cells, and discusses the etiology and the pathogeny of the disease. The condition is usually the sequel of unnoticed acute otitis and tends to become chronic. Anomalous development of the mastoid cells and conditions unfavorable to adequate drainage are usually present. The attic is regularly involved and becomes the central focus of a low grade infection that spreads slowly and progressively to the contiguous areas. Epitympanic otitis easily gives rise to complications in the mastoid and, on the other hand, anomalous pneumatization of the mastoid facilitates the occurrence of epitympanitis. Other factors influencing localization in the epitympanum are the type and virulence of the infecting organism and the general state of health of the patient.

DENNIS, San Diego, Calif.

CONTRIBUTION TO KNOWLEDGE OF THE LOCALIZATION OF BEGINNING COCHLEAR DISEASES. G. E. ARNOLD, Monatschr. f. Ohrenh. **73**:673 (Oct.) 1939.

As a continuation of his previous articles, the author discusses the possibility that an isolated lesion of the cochlear apparatus may begin in the fifth octave. It is not unlikely that so-called isolated vestibular lesions may be combined with such a cochlear disease, but these lesions can be recognized only with the aid of audiometric examinations. Possibly, also, some dysphemias (sigmatism) can be caused by defects in the cochlear apparatus, which are often overlooked. Arnold makes the point that in a case of toxic vestibular disease following sausage poisoning the cochlear disturbance was not revealed by the normal tuning fork findings and that the audiometer gave the evidence of it.

LEDERER, Chicago.

Nose

SPASMODIC RHINORRHEA. E. WATSON-WILLIAMS, Bristol Med.-Chir. J. **56**:109, 1939.

The author, a distinguished otolaryngologist, discusses this difficult problem classically. Several case reports are cited with a view to bringing out more forcefully important points of observation.

The symptoms of the condition are fully outlined, and the rhinologic observations on the allergic nasal mucosa are briefly discussed. Etiologic factors are dealt with in extenso, and some comments on the relation of the endocrine system, as well as neurogenic states, complete the section. The author then summarizes his suggestions to clinch a diagnosis and brings out a few case reports to drive home certain concepts acquired in his careful observations.

The treatment is divided into general measures, including desensitization, and local measures. He brings out some of the earlier methods, used by the hardy

Victorians, and those used by Gottstein and Zuckerkandl. At the end of the article is found this summary:

"1. During attack: local and general sedatives, calcium.

"2. Prophylaxis:

"(*a*) Avoid cause if known.

"(*b*) Desensitization with vaccines, particularly in hay fever.

"(*c*) Treat nasal disorders, especially sinusitis (often unsuspected).

"(*d*) Local desensitization: actual cautery very lightly applied to special areas; in obstinate cases, despite difficulties and discomfort chemical coagulation (including ionization) often succeeds."

GORDON, Philadelphia.

OSTEOMAS OF THE FRONTAL SINUS. GEORGE KELEMEN, Acta oto-laryng. **27**:528, 1939.

Four osteomas of the frontal sinus are presented. Three of the patients were operated on. There is nothing particularly new in the paper, but the subject of osteomas of the frontal sinus is well covered. GROVE, Milwaukee.

Miscellaneous

CIRCULATORY EFFECTS OF VOLATILE AMPHETAMINE (BENZEDRINE INHALER). C. M. PETERS and J. M. FAULKNER, Am. J. M. Sc. **198**:104 (July) 1939.

The authors recorded the effect on the pulse, blood pressure and electrocardiogram of five full inhalations of benzedrine through each nostril on a group of normal patients and a series of patients with various forms of organic heart disease. They were not able to demonstrate a significant effect. One patient with angina pectoris, however, could induce an attack by inhaling benzedrine. This is in harmony with the known effect of other sympathicomimetic drugs, such as ephedrine and epinephrine, both of which are able to induce attacks in patients with angina pectoris.

The authors conclude that heart disease is no contraindication to the normal therapeutic use of the benzedrine inhaler except that patients with angina pectoris should use it with caution if at all. SHAMBAUGH, Chicago.

CARDIO-INHIBITORY AND VASOMOTOR REFLEXES FROM THE NOSE AND THROAT. A. SIDNEY HARRIS, Ann. Otol., Rhin. & Laryng. **48**:311 (June) 1939.

The author describes the technic and results of experiments on rabbits to determine the changes in cardiac rate, blood pressure and respiratory rate due to stimulation of the nasal mucosa by various inhaled irritants. It was found that stimulation of the mucosa of the nose, pharynx and larynx by ether, acetic anhydride, ammonia or cigaret smoke produced a reflex cardiac inhibition with which was associated an initial drop in blood pressure. This pressure may quickly level off and gradually rise while the heart is slow and show a peak above the original when the cardiac rate approaches normal, or the pressure may remain below the control level until the original rate is reached.

Tactile stimuli in the nose and larynx produce a drop in pressure which may be steep and accompanied by some slowing of the pulse.

Faradic stimuli applied to the nerves supplying the mucosa of the upper respiratory tract in general produce responses comparable to those from tactile or chemical stimuli except that in the case of the trigeminal branches to the mucosa of the nose and skin of the snout there is relatively less cardiac inhibition and more rise in pressure and pain.

The primary vasodepressor and cardioinhibitory reflexes are delicate and may be eliminated by relatively light anesthesia and are depressed or eliminated by

much surgical or experimental trauma. In an animal in which these are depressed, stimuli, especially in the nose, raise blood pressure, and, if the anesthesia is not too deep, there is slowing of the heart secondary to the rise in pressure.

The author concludes that cardiac inhibition, vasomotor depression and excitation and the reactions secondary to increased pressure are excited through a distinct nervous mechanism.

Experiments on human beings indicate that the cardiovascular reflex systems of the normal person are quite insensitive to stimuli in the nose, but studies are cited which show that in certain pathologic states irritability is significantly increased.

M. V. MILLER, Philadelphia.

X-RAY TREATMENT OF INFECTIONS: A REVIEW OF THE LITERATURE AND REPORT OF CASES OF MASTOIDITIS AND SINUSITIS. B. R. DYSART, Ann. Otol., Rhin. & Laryng. **48**:433 (June) 1939.

The author reviews the literature showing the wide variety of cases in which roentgen therapy was of aid. He considers only cases of involvement of the mastoid and sinuses in the report which he presents. He seems to feel that conditions involving the mastoid respond better than those involving the sinuses. He advocates starting the treatment as early as possible and feels that small doses produce better results than larger ones, that very large doses may even be harmful.

M. V. MILLER, Philadelphia.

ENLARGED THYMUS. A. T. TYLER and W. E. HOLMES, Nebraska M. J. **24**:121 (April) 1939.

After the loss of an infant during anesthesia in the course of an operation for cleft palate, Tyler and Holmes examined 101 infants in the course of eleven years. They report that 47 per cent of these gave roentgen evidence of enlargement of the thymus. After roentgen treatment none of these infants had serious trouble with anesthesia. Bad effects did not follow the roentgen treatment.

HAMILTON, Omaha. [AM. J. DIS. CHILD.]

COMPARATIVE ANATOMY OF THE CENTRAL CONNECTIONS OF THE EIGHTH NERVE IN THE VERTEBRATE SERIES. A. KAPPERS, Oto-rhino-laryng. internat. **23**:337 (July) 1939.

Kappers studied the central connections of the eighth nerve in fishes, amphibians, reptiles, birds and mammals. In the fishes and the larvae of the batrachians the bulbar centers of the eighth nerve receive also the central terminations of the nerves of the lateral line. Their central fibers terminate in the dorsal part of the static region, which receives also the fine fibers of the lagena and the saccule and, in the higher animals, the auditory fibers. It is especially from the centers of the nerves of the lateral line and of the fibers of the saccule that the mesencephalic projection (the lateral fillet) is derived in the lower vertebrates. In the higher vertebrates the lateral fillet arises from the auditory centers. In all the vertebrates the central termination of the fine fibers of the lagena and the saccule is in the dorsal part of the static region, indicating that, at times, a part of the lagenal papilla and of the macula sacculi has an auditory function. The thicker fibers of the saccule are in relation with the cells of Deiters' nucleus and related nuclei situated beneath the dorsal region. Secondary fibers from these nuclei form the descending pathways, which are for the most part homolateral, and the reflex ascending pathways, which are mostly contralateral (dorsal longitudinal fasciculus). The utricular fibers have an analogous termination. In all the animals the secondary utricular fibers form the direct vestibulospinal bundle.

In all except the selaceans, amphibians and mammals, the large ampullar fibers have special spoonlike (*en cuiller*) terminations with the oval cells forming the

tangential nuclei; in selaceans, amphibians and mammals the cells keep their polygonal form. The tangential nuclei do not seem to participate in the formation of the direct vestibulospinal bundle, which arises from large cells with predominant utricular function. Most of the tangential cells send neurites into the posterior longitudinal bundle in order to serve ocular reflexes. Besides their spoonlike termination, thick ampullar fibers have ascending and descending collaterals.

The phylogenetic development of the central auditory projection is such that to the fine fibers of the lagena and the saccule are added the true auditory fibers from the auditory papillae or basilar membrane. As Larsell has shown, the central cells related to truly auditory fibers are the cells previously in relation with the nerves of the lateral line. With the disappearance of the latter and the apparition of the auditory papillae in the larvae of the batrachians, these cells come into neurobiotactic relation with the auditory fibers, which now form the principal source of stimulations passing in the lateral fillet, which was previously at the service of stimulations from the lateral nerves.

The first differentiation of the auditory center results in two nuclei: a dorsofrontal nucleus with small cells, and a larger, dorsocaudal, magnicellular nucleus. In the mammifera these nuclei undergo enlargement, accompanied by a displacement of their cells toward the cochlear root. This migration of the cells is accompanied by a partial displacement of the decussation of the lateral fillet, the larger part becoming ventral. The decussation of the lemniscal fibers of the acoustic tubercle keeps a dorsal position, but the superior olive and part of the ganglion of the isthmus are displaced ventrally.

The researches of Winkler, Lewy and Kobrak show that the ventral nucleus is in relation especially to the basal spiral, which receives tones of high frequency, not passing through the ossicular chain. The tuberculum acusticum receives vibrations of lower frequencies. This suggests an exact localization of perceptions of tone. There are also good arguments in favor of separate localizations in the cortex for sounds of higher and lower frequencies. DENNIS, San Diego, Calif.

TRANSFUSIONS IN THE TREATMENT OF SEPTICEMIA. GEORGES CANUYT, Rev. de laryng. **60**:345 (April) 1939.

The author reports 4 cases to emphasize to otolaryngologists the desirability of using blood transfusions to augment the classic treatment for septicemia.

BATSON, Philadelphia.

DEGLUTITION AND VOMITING: FUNCTION OF THE CARDIODIAPHRAGMATIC CANAL OF THE ESOPHAGUS. F. VENTURA-GREGORINI, Arch. ital. di otol. **51**:267 (May) 1939.

After an extensive and critical review of the literature on the motor mechanism, structure and function of, and the action of drugs on, the lower end of the esophagus, the author recounts his own researches. Valenti's notable contribution to this subject left unanswered the question of the existence of an anatomic (as opposed to a physiologic) cardiac sphincter. The effect of cocaine, atropine, pilocarpine, epinephrine, opium and curare on the function of the cardia, with special reference to the acts of swallowing and vomiting, is discussed. The question of the existence of a true sphincter is apparently not resolved, but the esophagus, from the diaphragmatic slit to the stomach, is believed to have a sphincteric action, to which the diaphragm contributes.

In a roentgenographic study of swallowing, Guns observed that pilocarpine lessened the time of passage of a bolus through the cardia, atropine sulfate prolonged the time and papaverine hydrochloride set up antiperistaltic movements of the esophagus; frequently, the curious phenomenon of alternate movements occurred until, unexpectedly, the cardia relaxed and the bolus entered the stomach. Ventura-Gregorini observed that in curarized dogs the cardiac vomiting tonus

was rapidly abolished, which harmonizes with the observations of Kuré on the effect of curare in the act of swallowing. This action occurred even after the vagus nerves in the neck had been cocainized. The phrenocardiac tract of the esophagus is normally in a state of tonus, which is not overcome by atropine because the latter abolishes the function of the vagal centripetal pathway, and therefore the order to relax the phrenocardiac tonus is not transmitted to the centers. The inhibitory reflex in relation to the act of vomiting (and swallowing) is located in the pharynx and the upper part of the esophagus, the titillation of which provokes opening of the cardia. It is well known that the cardiac tonus is easily relaxed in the act of swallowing but is highly resistant to regurgitation of the contents of the stomach.

The anatomic structure of the phrenocardiac tract has a teleologic value with relation to various animals. In rabbits and horses, which are herbiverous, and in which the phrenocardiac structure is smooth muscle, vomiting is impossible; in dogs, in which the muscle is mixed, vomiting is easy, while in man, in whom the phrenocardiac muscle is smooth but with some striated muscle fibers coming from the diaphragmatic ring, vomiting is relatively easy. In addition, the difficulty of opening this sphincter is in relation to the state of fulness of the stomach; with a full stomach the cardia tends to remain firmly closed.

For phrenocardiac spasm, belladonna and papaverine are contraindicated, since they do not relax cardiac tonus. Spastic states of the phrenocardiac canal may be related to the facility with which the stomach empties itself, perhaps through functional disturbance.

DENNIS, San Diego, Calif.

AZOTEMIA IN OTOLARYNGOLOGY. C. PAOLO, Arch. ital. di otol. **51**:366 (July) 1939.

In patients after operation, the normal course of protein exchange is modified by the dietary regimen, the anesthetic, the nature of the operation and the state of the liver and kidneys. Accepting as normal variations of 0.20 to 0.40 Gm. per thousand in the urea content of the blood, Paolo studied the urea in the blood of 88 patients, operated on for the following conditions: adenoid vegetations, 20; nasal fracture, 4; hypertrophied tonsils, 10; nasal polyps, 8; polyps of the vocal cord, 4; auricular polyps, 6; hypertrophied turbinates, 10; septal, deviations, 10; acute mastoiditis, 12, and frontal sinusitis, 4. Only in the cases of mastoiditis was ether used as an anesthetic. In the cases of violence (nasal fracture) and of mastoiditis there was increase of urea in the blood, amounting to as high as 0.70 per cent. In the other cases there was no increase, which may be partly because the greater number were children. The increases in the cases of nasal fracture and of mastoiditis may be attributed to cellular disintegration and its absorption, the anesthetic and shock.

DENNIS, San Diego, Calif.

EFFECTS OF EXCITATION OF THE POSTERIOR LABYRINTH ON THE MOTOR ACTIVITY OF THE UTERUS. C. CONCETTI and T. RODOLFO-MASERA, Arch. ital. di otol. **51**:370 (July) 1939.

Because of the known fact that stimulation or destruction of the labyrinth may influence some vegetative functions, the authors conducted a series of experiments on 11 rabbits, in order to determine the effects of labyrinthine stimulations on uterine contractions. Both rotatory and caloric stimuli were used. Eight of the animals had been sequestered from males and from their offspring for some time before the tests; the others had been allowed to nurse their young. Three of the animals subjected to the rotation test had first undergone section of the spinal cord at the eighth thoracic vertebral level.

The conclusions from the results of the experiments are that the effects of the stimulations were so varied in their manifestations that a direct relation between the labyrinth and the uterus cannot be inferred; it is more probable that the labyrinthine stimulation acts indirectly as a generic stimulant. In the caloric tests, direct excitation of the fibers of the vegetative nervous system could not be excluded.

DENNIS, San Diego, Calif.

NEW ROENTGENOGRAPHIC METHODS FOR LOCALIZING FOREIGN BODIES IN SOFT TISSUES. A. BOVET, Monatschr. f. Ohrenh. **73**:365 (June) 1939.

To indicate the exact position of foreign bodies in the soft tissues of the neck, the author has devised a wire cross in the manner of a coordinate cross, which is subdivided so that the location found in the roentgenograms can be shown on the skin. A third wire, attached at the crossing point of the two other wires, indicates the direction of the roentgen ray in one plane. In the other exposure, this wire should appear at full length so as to ascertain the rectangular relation of both views. A case is described in which this method has been successfully employed.

LEDERER, Chicago.

THYROID NODES IN THE TRACHEA. B. SZENDE, Monatschr. f. Ohrenh. **73**:375 (June) 1939.

In a patient with a malignant goiter, a benign, colloidal strumous node about the size of a peanut was found occluding the trachea. The trachea was found intact, so that the author believes that the node was a compensatory formation of thyroid tissue derived from embryonic displaced roots which developed after radical removal of the thyroid. After some plastic difficulties, recovery ensued. Three illustrations accompany the case report.

LEDERER, Chicago.

OSTEODYSTROPHIA FIBROSA OF THE CRANIAL BONES. KARL HELLMANN, Pract. oto-rhino-laryng. **2**:190 (July) 1939.

The author presents 4 cases of osteodystrophia fibrosa of the facial bones. In 1 case the condition was of two months' duration, while in the other 3 it varied from one to two years. He describes the pathologic change as the generation of laminated substantia spongiosa, which is rich in fibrillae. Later, this undergoes degeneration and transmutation into a tissue that resembles a mosaic-like breccia, which is relatively poor in fibrillae. The bony substance, originally laminated, through osteoclasis becomes spotty or flaky in character. Cystic degeneration is common and may either occur about the blood vessels (hematogenous) or form what the author terms a pseudocyst. Cysts of the latter type are probably due to the tearing of the fibers within the connective tissue. The marked density of the tumor makes it impossible to diagnose the process roentgenologically. The author does not believe that there is any relation between this local process and any generalized skeletal disease, such as Paget's or von Recklinghausen's disease.

PERSKY, Philadelphia.

NEPHROPATHIES IN THE COURSE OF ACUTE NASOPHARYNGEAL DISEASES OF INFANTS. D. TIMUS and V. PETRESCU-COMAN, Med. inf., Roumania **1**:104 (Feb.) 1939.

Timus and Petrescu-Coman show that, aside from the usual diseases which cause renal lesions in a baby, severe transient infections of the rhinopharynx are important. In methodic examinations of the urines of babies having coryza, pharyngitis or tonsillitis they have noticed that in almost all there are renal lesions varying in intensity and duration. The development of nephritis is favored by many factors: a certain renal predisposition, congenital syphilis, lymphatism and status thymicolymphaticus. To these the authors add from their own observation an advanced state of dystrophy. The renal lesions are manifested by edema, vomiting and diarrhea. Examination of the urine shows albumin, red cells, leukocytes and, in severe cases, granular casts and desquamated epithelium of the urinary tract. The authors record a series of cases in which renal lesions of variable intensity and course were shown, among others, cases of follicular tonsillitis, pharyngitis and otitis and repeated tonsillitis. In cases in which after recovery from nasopharyngeal lesions there persists an unexplained subfebrile state, it is necessary to examine the urine, which in the majority of cases will indicate the presence of renal lesions.

FROM AUTHOR'S SUMMARY. [Am. J. Dis. Child.]

STUDIES OF A VESTIBULAR SYNDROME INDUCED IN GUINEA PIGS BY ALLERGIC REACTION. TORSTEN SKOOG, Acta oto-laryng., 1939, supp. 32.

By making centripetal intracarotid injections of sheep-hemolytic rabbit serum into a large number of guinea pigs Skoog studied the clinical syndrome thus allergically produced and tried to determine the location of the allergically affected tissue.

The investigations led to the following conclusions:

The anatomic arrangement of the cervical vessels in the guinea pig is such that the serum must always be injected into the right carotid artery in order to secure comparable results, because the left carotid artery varies so much anatomically in different animals. Serum injected in a centripetal direction, toward the aorta, is carried by the meeting blood stream along the right subclavian and the right vertebral artery into the right half of the brain stem.

Injections in the opposite direction—toward the cerebrum—produced no symptoms at all, even when the dose of serum was trebled.

The symptoms which follow intracarotid centripetal injection on the right are characterized by certain vestibular phenomena: twisting of the head and the whole body to the left and "circus movement" to the left, as well as constant ocular deviations and disturbances of the normal caloric and rotatory reactions.

The symptoms are to be regarded as vestibular phenomena of irritation produced by disturbances in the vestibular ganglions of the medulla oblongata, for preliminary removal of the peripheral labyrinths and the cerebellum had no influence on the character of the symptom complex.

The pathologic-anatomic foundation of the symptoms is to be found in an allergically induced increased capillary permeability in the medullopontile region with hemorrhages. This fact was verified by intravitam staining with acid dyes (Sudan III), with which an intense staining of this region can be observed.

This allergically induced breakdown of the capillary blood-brain barrier to the acid vital dyes has not in this series of experiments been observed after corresponding injections of serum into the capillary system of the cerebrum, a fact that may be regarded as pointing to the existence in the central nervous system of capillary areas that react differently in an allergic respect.

Although the results obtained cannot be considered directly applicable to man, they should, none the less, be of interest in view of the conception respecting the allergic genesis of certain forms of Ménière's disease.

The localization of these allergically produced vestibular disturbances in experimental animals in the central vestibular areas in the medulla oblongata does not in any way exclude the possibility that in man the peripheral labyrinth may participate, since one can well conceive of allergically sensitive tissue being present in this organ also. Variations in the allergic sensitivity of various organs in different species of animals are well known.

GROVE, Milwaukee.

Society Transactions

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY

GEORGE T. JORDAN, M.D., *President*

WALTER H. THEOBALD, M.D., *Secretary*

Regular Monthly Meeting, Feb. 5, 1940

Symposium on Syphilis

Interpretation of Serologic Reactions Based on a Nationwide Survey. DR. FRANCIS E. SENEAR.

The interest in the serology of syphilis has perhaps not kept pace with the interest in the more general phases of the subject, so far as the medical profession at large is concerned and particularly with respect to the public. However, the field has become just as complex as that of the therapy of syphilis.

Since 1923 three meetings have been held under the direction of the League of Nations for the purpose of making a study of the various tests used in the diagnosis of syphilis. At the third meeting, held in Uruguay in 1938, it was concluded that the Kahn test was the best. The American Society of Clinical Pathology, however, recognizing that a number of tests developed in the United States had not been adequately represented, asked Surgeon General Parran to arrange a further study, as a result of which request a call was sent out to thirteen outstanding serologists who had developed tests or modified already existing ones so that they were considered separate tests. Blood was sent to these men and examined in their own laboratories, while in the League of Nations competitions the serologists went to the country in which the contest was held and competed in strange surroundings. After this first study, five men whose tests were widely enough used throughout the country and were outstanding, were chosen as controls for further work of this organization. These men were Drs. Kahn, Kline, Kolmer, Hinton and Eagle. Each of these, with the exception of Kolmer, uses a flocculation test; Eagle and Kline also have developed complement fixation tests, but these are not used as much as the flocculation method.

It was then decided to find out the general caliber of laboratory work throughout the country. Invitations were sent to a number of laboratories—state, municipal, hospital and private; in the study as it pertained to those using the Kahn test, Kahn performed the control tests, and the same was true with the other tests. It was interesting to find that with the known syphilitic serums assigned to those using the Kolmer test, for example, Kolmer obtained 59 per cent positive results. This does not mean that he should have obtained 100 per cent, for many of the patients had been treated or had syphilis of such long standing that the reaction had spontaneously become negative. From 14 laboratories using the Kolmer test, the reports were of anywhere from 32 to 62 positive reactions, some laboratories obtaining positive reactions in not more than 50 per cent of instances in which the reaction should have been positive.

The next applied to the state laboratories alone. In the first study 39 state laboratories participated. Each received a specimen of blood, and the control investigators received exactly comparable samples. Two of the state laboratories

reported 8 and 10 per cent of false positive reactions respectively. In this same study the control laboratories reported positive reactions in 87 per cent of the known syphilitic serums. The general average of state laboratories was 16 per cent below, these laboratories failing on the average to detect syphilis in 16 out of 86 cases in which it should have been possible to do so.

The next year a similar study was made, with 44 state laboratories participating. As a consequence of the previous studies they had taken steps to improve their technic, and in this study their results were only 9 per cent below those of the control group. None had over 2 per cent of false reactions. A third study was carried out the following year, in which only 38 laboratories participated; 10 whose results had been good were asked not to participate, because the collection of blood was such a complicated and laborious procedure, 250 to 275 cc. of blood being taken from each person, either syphilitic or control. In this test the number of laboratories classed as unsatisfactory dropped to 22, as compared with 30 in the preceding year.

As to what can be done with good technic in laboratory diagnosis of syphilis, it is interesting to note that in the 1938 study not a single false positive or false doubtful reaction was reported by any of the control serologists. Next month the annual study for this year will be started, and a steady improvement is expected. This brings up a brief consideration of what should be looked for in the interpretation of reactions, what should be known of the possibilities of diagnosis of syphilis from the laboratory standpoint. In the early stage the reaction is negative; it is ordinarily ten days to two weeks before any appreciable portion of positive reactions is obtained. In a week one may expect 25 per cent, and when the flocculation test is used the reaction becomes positive somewhat earlier. Toward the secondary period the proportion of positive reactions becomes greater, and 100 per cent of positive reactions have been found in the secondary period by the control serologists. In the later, or tertiary, stage the proportion drops materially; only about 75 per cent of patients have positive reactions. For congenital syphilis and dementia paralytica the proportion is high, about 96 to 98 per cent. Tabes, on the other hand, runs low, 65 to 70 per cent. Yaws, or frambesia, a tropical disease rarely seen in this country, gives a high proportion of positive reactions, about 75 per cent, and leprosy gives 40 to 70 per cent positive reactions. Malaria has a considerable proportion, particularly in the febrile stage. Various other conditions, such as jaundice, malignant growths, pregnancy, diabetes, febrile diseases and tuberculosis, have been capable of producing biologic false positive reactions, but these conditions are of influence in only a small proportion of cases, if at all. Recent studies by the National Tuberculosis Association show that all kinds of tuberculosis may be discarded as a cause of positive reaction. Malignant growths and other conditions mentioned are rarely of importance, but in cases of infectious mononucleosis if the blood is taken at the right time a positive reaction is often obtained. Children with a febrile course occasionally have positive reactions, the reaction reverting to negative after disappearance of the febrile disease.

There is one type of reaction which should be mentioned, the so-called paradoxic reaction. In rare instances a patient with no history or signs of syphilis will on one day have a positive reaction, usually weak, and a week from that day will have a negative reaction, and within another two weeks will have a weakly positive reaction. The same laboratory one day may report a negative Wassermann and a positive Kahn reaction, or on blood drawn at the same time one laboratory will report a 2 plus and the other a negative reaction. Spanswick estimated that this occurred once in 5,000 tests. These reactions are difficult for the syphilologist to evaluate, as one does not know whether or not to treat the patient. They are encountered occasionally and usually turn out to be nonsyphilitic, biologic, false positive reactions.

Summary.—One should know the quality of the work done by the laboratory one employs. The standard is undoubtedly being raised and will continue to be raised as the state laboratories extend opportunities for evaluation to the laboratories within their confines. A poor laboratory may fail in many cases of syphilis to obtain a positive reaction or may often get false positive reactions.

Lesions of the Mouth. Dr. James H. Mitchell.

The lesions of the mouth in syphilis may be divided into early, late and congenital. The most important part of early syphilis is the primary lesion, and the most common site for this is the lip, usually the lower. The appearance and character of that lesion, the chancre, is well known. It is not an ulcer, but an erosion, a hard, palpable lesion, a button. It is absolutely without sensation and ordinarily without secondary infection. There are possible sources of error in diagnosing various other lesions, such as a herpetic lesion which has been treated with irritants until it has become indurated and closely simulates a chancre. An important diagnostic point, however, is the regional adenopathy, which is occasionally bilateral, but usually on one side or the other, and painless on palpation.

When the crust is removed from one of these lesions a clear serum exudes, and in this serum Spirochaeta pallida is found by means of the dark field. All lesions about the mouth must be carefully examined, because an organism occurs in the mouth which is so much like S. pallida that I should not attempt to differentiate the two.

The tongue is the next most common location for the chancre, and then the tonsils. I have observed a great many cases, I regret to say, in which tonsillar chancres have been removed by tonsillectomy. I regret to say also that I have seen a number of chancres inside the nares of the rhinologists and laryngologists who have come in contact with chancres and have acquired the lesions through carelessness. I have seen a number of chancres in the eye. The gum is a rare location for chancre. In the tonsil the chancre is often mistaken for Vincent's angina. In a case of really pronounced Vincent's angina there are probably some fever and adenopathy, but not like those associated with a true chancre.

(Slides were presented.)

Rhinologic Aspects. Dr. Lawrence J. Lawson.

Syphilis of the nose is important because in a high percentage of patients with syphilis, unless actively treated, nasal changes develop sooner or later. Syphilis in the nose can cause serious threat to life. Its sequelae are grave. Permanent disfigurement causes social limitations. There is interference with speech and with character of voice. Changes occur in respiration and deglutition. Insidious symptoms are often obscure. At times the lesions progress with extraordinary rapidity.

(The lesions of hereditary and acquired syphilis, as seen in the nose, were described in detail.)

In conclusion it is stated that it is fair to presume that factors now at work, if not interrupted by war or by lowered economic status, will reduce the incidence of advanced syphilitic nasal damage to a low level. Certainly this is becoming true in private practice and in the clinics. Modern American medicine is alert and progressive. Blood testing of all pregnant women in Illinois is now required by law. With both antepartum and premarital tests and the growing tendency for group testing leading to early recognition of syphilis, fewer of the more serious manifestations of syphilis of the nose will be allowed to develop.

The high number of fresh infections cited in current reports makes it important that syphilitic manifestations be recognized, especially those of the nose, where involvement is frequent.

Otologic Aspects. Dr. Samuel J. Pearlman.

Few otologists observe many cases of syphilis of the ear. It may be that a number are missed, but in general it is agreed that syphilis of the ear is not common.

Chancre and condylomas occur on the concha and in the external auditory canal. Chancre was reported as seen not infrequently in European clinics and was said to be due to the improper sterilization of hard rubber catheters. Stenosis of the eustachian tube can also occur as a sequel to syphilitic scarring of the nasopharynx.

Syphilis of the ear may be divided into three main types:

1. Late hereditary type. This comes on about puberty. It is associated with other stigmas of hereditary syphilis as described by Hutchinson and produces a sudden and incurable deafness of the perception type.

2. Infantile prenatal type. The patient is born often with obvious and severe evidences of syphilis involving such parts as skin, viscera and brain, and the death rate is high. Many of these children do not live longer than a few weeks or months.

3. The acquired type. The main findings are deformities of the footplate of the stapes, which may be bowed in or out, and deformities of the crura. Periostitis gummosa may be seen, according to some, in the middle ear, in the region of the ossicles and in the mastoid process. One of the most interesting findings is a productive periostitis (nongummatous). In addition, there are varying degrees of atrophy of the spiral ganglion cells and degenerative changes in the organ of Corti, as well as in the acoustic nerve in Rosenthal's canal and in Reissner's membrane. Round cell infiltration occurs in the cochlea along the basement membrane, in the striae vasculares, in the spinal ligament and the modiolus and in the internal auditory meatus along the fibers of the eighth nerve.

Some of the round cell infiltration is perivascular.

As for diagnosis, there are few instances in which the symptoms are unique for syphilis. The late congenital types occur at or about puberty and are characterized by hutchinsonian stigmas, sudden onset of the deafness, which is profound, and labyrinthine phenomena.

There are some who claim that the findings in syphilis are characteristic along with profound deafness of a perception type. It is said that bizarre findings are seen, such as loss of reaction to the caloric test but retention of reaction for rotation and vice versa. The significance of these findings is disputed by others. In Vienna for a long time a shortened bone conduction in the presence of fairly good hearing was considered to be pathognomonic of syphilis, and this diagnosis was made at times with no other findings present or even sought.

Treatment of syphilitic deafness of the perception type, either congenital or acquired, is disappointing, with the exception, according to Mackenzie, of the type seen in cerebrospinal syphilis with meningitic involvement. Vigorous therapeusis often gives favorable results.

It would seem that with the careful antepartum care given in large parts of the country, the infantile, or prenatal, and the late hereditary types will gradually disappear. As for the acquired types of syphilitic deafness, the present campaign against the disease in general in this country will no doubt cause fewer numbers of this type to be seen as time goes on.

Laryngeal Lesions. Dr. John Delph.

Syphilis as seen in the larynx is a local manifestation of a general disease. No accurate statistics are available on the incidence of syphilitic laryngitis, although with its relation to diseases of the larynx in general it is believed to occur in about 6 per cent of cases and to be more prevalent in males than in females.

The primary lesion is rarely encountered in the larynx, although there are reports in the literature of chancre of the epiglottis. This is explained by the fact that the initial lesion is almost always single and infection, by kissing for instance, is almost sure to attack the mucosa higher in the respiratory tract. Also, the laryngeal mucosa is well protected from all invaders except those that are air borne.

The lesions of the larynx are described in the various stages. The chief symptom in the early stages is hoarseness. There is usually no pain or cough. Diagnosis cannot be made on the basis of symptoms or previous history only. It has been said that if one could observe enough cases one would learn to suspect syphilis from the characteristic appearance of the mucosa. The primary considerations in differential diagnosis are tuberculosis and malignant growth. Biopsy should be done if there is any question.

Treatment of syphilis of the larynx, hereditary or acquired, should be left to the syphilologist, and the laryngologist should confine himself to observation and be prepared to meet any emergency that may arise. The prognosis is usually satisfactory unless the cartilage has been involved, in which case surgical intervention may be necessary. Unless the ulcers are in the subglottic space or in the region of the arytenoid articulation, there is little danger to life.

Dermatologic Reactions in the Treatment of Syphilis. DR. JOSEPH WELFELD.

The cutaneous aspects of syphilis and its reactions, together with common dermal lesions simulating syphilis, are described as encountered at the Municipal Social Hygiene Clinic, where approximately 1,500 patients with syphilis are seen daily. Patients exhibiting the cutaneous manifestations are referred to the dermatologic department for a complete check-up before any treatment is instituted. Those who have received treatment and show reactions are sent back to that department, where their future therapy is determined.

The mechanism of reactions to drugs is not known. The drugs may act directly on the skin, or indirectly by primary effect on the liver. It is known, however, that in most instances a definite hypersensitiveness of the skin may exist.

Eruptions caused by a drug are sometimes difficult to distinguish from other cutaneous manifestations. The diagnosis can be established only by careful questioning, by obtaining a history of the taking of drugs, by noting an improvement of dermal lesions when administration is stopped and by testing the patient's sensitiveness to the drug.

The eruptions fall into four general categories: (1) vascular reactions, (2) eczematous reactions, (3) follicular reactions and (4) ulcerating and vegetating eruptions.

It is found that these patients exhibit typical lesions of neurodermatitis, and it has been concluded that pruritus with lichenification must have some relation to syphilis, for so large a percentage of patients with that condition improve when given antisyphilitic therapy.

The reactions are classified into two groups: cutaneous and constitutional reactions. Reactions should be anticipated when a patient presents a history of previous dermatoses, such as pruritus, urticaria, eczema, hay fever and asthma.

Reaction frequently occurs after the first injection, and at times there seems to be hypersusceptibility created by long rest between injections. A mild eruption appears, such as morbilliform and scarlatiniform erythema and eczema followed by desquamation. It is usually of short duration and undoubtedly is due to anaphylaxis.

The constitutional reactions are divided into three groups: immediate, slightly delayed and delayed.

Immediate nitroid reactions occur during the injections or immediately afterward. There is a sudden vasomotor disturbance in the train of symptoms.

Slightly delayed reactions are due to the administration of arsphenamine and are symptomatically described as follows: nausea, vomiting, diarrhea, chills, headache, urticaria, fever and articular pain. They require no treatment unless they are prolonged and continuous.

In delayed reactions there are numerous types of dermatitis, but the principal object is to avoid the vesicular and exfoliative conditions, which cause long invalidism and may result in death.

DISCUSSION ON PAPERS IN SYMPOSIUM

DR. JAMES H. MITCHELL: I have been in close touch with Dr. Senear's work for a long time and have had the pleasure of reading his paper which appeared in the collected papers of the symposium of the Association for the Advancement of Science at the Indianapolis session. I think all who are interested in the subject would do well to read this paper. In 1926 I read a paper at the Dallas meeting of the American Medical Association showing what terrible things can result from false positive reactions; there were some rather tragic episodes in that report. I think all physicians should bear in mind the possible tragedies that may occur as a result of false positive reactions.

DR. JOHN E. MUSLOW: About eighteen years ago, before the Wassermann test was compulsory at my clinic, I became interested in syphilis with regard to chronic infection of the ear, nose and throat. Wassermann tests done at that time on 370 unselected patients revealed a 4 plus reaction in 65 and a reaction of 2 or of 1 plus in 24 patients. Among the group having a 4 plus Wassermann reaction were a fairly large number of patients who had had several operations for various chronic sinus conditions with no definite improvement. Included in this group were several with chronic aural and laryngeal conditions which had not responded to conservative treatment. One case comes to my mind particularly. A man had been referred to the otologic clinic with a diagnosis of an abscess of the brain. Examination showed a profuse greenish, malodorous discharge from the left ear. The Wassermann reaction was 4 plus. With antisyphilitic treatment combined with conservative treatment of the ear, the condition healed. The patient had normal hearing in this ear when discharged. The mucous patch in the mouth is familiar; why should a mucous patch in the antrum, eustachian tube or middle ear not be thought of also? A likely complication would be a superimposed pyogenic infection and perhaps bone destruction. I feel that it is imperative to make a Wassermann test in all cases of chronic infection of the ear, nose and throat that does not respond to the ordinary methods of treatment. As. Drs. Lawson and Mitchell have stated, the atrocious tertiary lesions of the nose and throat are seldom seen today. This is especially true of the past ten years of my experience.

DR. SHERMAN SHAPIRO: I should like to add a few words to Dr. Pearlman's able presentation of syphilis of the ear, particularly in reference to that of the inner ear. With regard to shortened bone conduction, I think it is now generally agreed that this finding is simply evidence of profound involvement of the inner ear and may be found not only in syphilis but in many types of deafness due to disease of the inner ear. I was interested in what he said about the so-called paradoxic labyrinthine reaction. I have seen this in cases of syphilis as well as in association with other conditions. It is supposed to be due to a retrolabyrinthine process. The symptom is of great interest, and I do not know of any adequate explanation for it. An occasional finding which was not mentioned is the Hennebert fistula sign reaction, which is practically pathognomonic for syphilis of the inner ear.

DR. WALTER THEOBALD: Referring to the case Dr. Mitchell showed in which a tongue was treated for a malignant process and the condition later proved to be syphilis in the absence of a positive Wassermann reaction, I should like to ask a question: What, if anything, can Dr. Mitchell say about provocative treatment or provocative manifestations? That is, when one is in doubt, is there any means of provoking the blood so that a positive Wassermann reaction can be obtained?

DR. HOWARD C. BALLENGER: In the discussion of the complications of the treatment of syphilis by means of the arsenicals and mercury, the sudden onset of deafness which was formerly seen was not mentioned. Other cranial nerves have been reported as being involved at times. When cases of this condition were mentioned several years ago it was thought to be due to faulty preparation of the drug or to use of insufficiently large doses. This complication does not seem to be so common in recent years. I wonder if any of the speakers have observed this result from the use of the arsenicals.

DR. JAMES H. MITCHELL: I think Dr. Senear will agree that the provocative reaction is of great value in dermatology. It has been known for a long time that from 25 to 30 per cent of patients with the disease in the late stage give a negative reaction. The procedure consists of giving a small dose of neoarsphenamine or old arsphenamine and then waiting for three weeks. Leredde, who first proposed this, suggested a three week period, in view of the fact that the Wassermann reaction is slow in becoming positive in cases of primary infection. Some advise testing the blood the next day or within three days, but according to my experience it is better to wait three weeks. In that way plenty of time is allowed for the Wassermann reaction to become positive and also for a therapeutic result to occur; both a therapeutic test and a serologic test are obtained. This method has been of great value in my experience.

DR. JOSEPH WELFELD: Fixed pigmentations have entirely different characteristics than do those mentioned by Dr. Mitchell, which are caused by practically the same drugs. Cases of those pigmentations have been grouped separately, and the anomalies have been observed by other dermatologists as true arsenical melanosis.

It can be said that in a large per cent of cases all characteristics of neurodermatitis develop, a fact which I emphasized. Are they due to syphilis? I presume there must be some relation to syphilis, for they improve when arsenical therapy is given.

DR. F. E. SENEAR: Dr. Welfeld spoke of the occurrence of hyperkeratotic lesions. I do not see them occurring as a result of syphilis in my cases. It is known that lichenification is seen in Negro patients to an extent to which it is not seen in the white. Administration of arsenic is an old remedy in the treatment of hyperkeratosis, and I feel that it might have an effect on dermatitis but that such an effect would be only an indirect result of therapy.

In reply to Dr. Welfeld's question, I have not seen any form of simple lichenification of neurodermatic type which I could attribute to syphilis. I did not understand whether he attributed that to syphilis.

Book Reviews

Cańcer laringeo: Su tratamento quirúrgico. By Dr. Ricardo H. Bisi. Paper. Pp. 355, with 101 illustrations. Buenos Aires: "El Ateneo," 1938.

Dr. Bisi's book presents comprehensively the subject of surgical treatment of cancer of the larynx. The first chapters are devoted to historical data and to general considerations. The pathologic structure is treated after the manner of the distinguished French laryngologist Leroux-Robert.

Diagnosis is considered at length, both indirect and direct laryngoscopic examination being described as important diagnostic methods. Biopsy in all cases is advised. Roentgenographic examination, in the lateral projection as well as by the tomographic method, is emphasized as helpful in certain cases. The latter method is credited to Felix Leborgne, of Montevideo, Uruguay, who described it in July 1936. The method in which an intrapharyngeal plaque is used (Rethi, Waldapfel and Carminatti) is mentioned, but tomographic studies are regarded as superior. The various biologic reactions used in diagnosing cancer are also discussed and tabulated.

Bisi mentions the classification of cancer of the larynx into "intrinsic" and "extrinsic," suggested by Isambert, and St. Clair Thomson's addition of "subglottic and mixed," but he follows in his own work the classification suggested by Leroux-Robert, which is a classification into three groups: (1) intralaryngeal, (2) pharyngoloaryngeal and (3) hypopharyngeal. Each of these three varieties is discussed in detail under the following headings: macroscopic appearance, symptomatology, laryngoscopic appearance, adenopathy, radiography, evolution and propagation.

The bulk of the book, as its title implies, is concerned with surgical treatment, and the indications for the various surgical procedures are considered in two ways: first, the operations that are indicated in certain varieties of cases, and, secondly, the various operations and their respective indications.

Bisi advises that we "always choose a more radical procedure than we think necessary" in the particular case. He is conservative with regard to age, advising against surgical intervention in the case of any patient over 55 years of age! Other contraindications besides advanced age are (1) invasion of surrounding tissues and (2) the presence of cancerous glands adherent to the carotid sheath.

During the preoperative period the author forbids the use of tobacco and alcohol, attempts to eradicate dental and gingival infection and puts the patient on a regimen of general medical care with attention to high blood pressure or any other disorder, so that he may be in the best possible condition for operation.

The following operations are thoroughly considered: (1) classic or simple thyrotomy, (2) thyrotomy with resection of the thyroid cartilage (St. Clair Thomson), (3) hemilaryngectomy by the Hautant technic, (4) epiglottectomy, (5) simple laryngectomy (Gluck-Tapia), (6) laryngectomy with extirpation of the preepiglottic space and (7) more radical operations with the resection of various adjacent parts. Bisi condemns preliminary tracheotomy but states that if it is required for relief of dyspnea it should be done as low as possible. He calls particular attention to the importance of the removal of the preepiglottic space and hyoid bone in all cases of carcinoma of the vestibule, that is, all cases in which there is involvement of the ventricular bands, ventricles or epiglottis.

Postoperative care, complications and their management, the surgical treatment of metastatic glands, postoperative roentgen therapy and the development of voice after laryngectomy are all matters that receive due consideration in this comprehensive book.

Directory of Otolaryngologic Societies *

NATIONAL

American Medical Association, Scientific Assembly, Section on Laryngology, Otology and Rhinology

Chairman: Dr. LeRoy A. Schall, 243 Charles St., Boston.
Secretary: Dr. Louis H. Clerf, 1530 Locust St., Philadelphia.
Place: Cleveland.

American Academy of Ophthalmology and Otolaryngology

President: Dr. Frank Brawley, 30 N. Michigan Ave., Chicago.
Executive Secretary: Dr. William P. Wherry, 1500 Medical Arts Bldg., Omaha.
Place: Hotel Cleveland, Cleveland. Time: Oct. 6-11, 1940.

American Broncho-Esophagological Association

President: Dr. Gabriel Tucker, 250 S. 18th St., Philadelphia.
Secretary: Dr. Paul Holinger, 1150 N. State St., Chicago.

American Laryngological Association

President: Dr. Gordon Berry, 36 Pleasant St., Worcester, Mass.
Secretary: Dr. Charles J. Imperatori, 108 E. 38th St., New York.
Place: Atlantic City, N. J. Time: May 28-30, 1941.

American Laryngological, Rhinological and Otological Society, Inc.

President: Dr. J. Mackenzie Brown, 1136 W. 6th St., Los Angeles.
Secretary: Dr. C. Stewart Nash, 708 Medical Arts Bldg., Rochester, N. Y.
Place: Los Angeles. Time: June 1941.

SECTIONS:

Eastern.—Chairman: Dr. N. S. Weinberger, Robert Packer Hosp., Sayre, Pa.
Southern.—Chairman: Dr. William G. Kennon, Doctors Bldg., Nashville, Tenn.
Middle.—Chairman: Dr. Walter H. Theobald, 307 N. Michigan Ave., Chicago.
Western.—Chairman: Dr. Robert C. Martin, 384 Post St., San Francisco.

American Otological Society

President: Dr. Horace Newhart, 527 Medical Arts Bldg., Minneapolis.
Secretary: Dr. Thomas J. Harris, 104 E. 40th St., New York.

* Secretaries of societies are requested to furnish the information necessary to keep this list up to date.